SCIENCE AND ART DEPARTMENT
OF THE COMMITTEE OF COUNCIL ON EDUCATION,
SOUTH KENSINGTON.

DIRECTORY,

(*Revised to February* 1869.)

19th EDITION.

WITH

REGULATIONS

FOR

ESTABLISHING AND CONDUCTING

SCIENCE SCHOOLS & CLASSES.

THE RULES IN THE PRESENT EDITION SUPERSEDE THOSE IN ALL FORMER EDITIONS,
BUT ARE ALWAYS SUBJECT TO REVISION.

LONDON:
PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

SOLD BY CHAPMAN AND HALL,
193 PICCADILLY, LONDON.

1869.

Price Sixpence

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SUMMARY of the NATURE and AMOUNT of ASSISTANCE afforded by the SCIENCE AND ART DEPARTMENT to the INDUSTRIAL CLASSES in procuring INSTRUCTION in SCIENCE.

[*Important Alterations made since the last edition of the Directory are printed in Italics.*]

I. A sum of money is voted annually by Parliament for scientific instruction in the United Kingdom.

II. This sum is administered by the Science and Art Department.

III. The head of the Education Department, of which the Science and Art Department is a branch, is the Lord President of the Council, assisted by a member of the Privy Council, who is called the Vice-President of the Committee on Education, and who acts under the direction of the Lord President, and for him in his absence. (Order in Council, 25th February 1856, Act 19 & 20 Vict. c. 116.)

IV. The object of the grant is to promote instruction in Science especially among the industrial classes,* by affording a limited and partial aid or stimulus towards the founding and maintenance of Science schools and classes.†

V. The payment of fees by the students can be looked upon as the only solid and sufficient basis on which a self-supporting system can be established Payment of Fees by Students.

* Direct payments are made to teachers only on behalf of adult *artisans*, or the children of artisans, or the children of persons who are not assessed to the income tax, that is, who do not possess an income of 100*l*. a year. (See § xxiii.)

† The amount is liable to be decreased and eventually withdrawn. Payments to teachers therefore must not be looked upon as perpetual, or in any way conferring on the teacher a claim to any payments beyond those offered for each current year.

and supported. Though my Lords do not consider it necessary at present to lay down any rules making the payment of fees an absolute condition of the grants on account of Science instruction, yet as the payments from the State must be expected to diminish, and as aid on account of those persons who do nothing for themselves cannot be justified, Committees of schools and classes and teachers are strongly urged (should it at present not be the practice) at once to impose as high a scale of fees as they consider can be raised not only on middle class students but also on artisans.

VI. The following are the Sciences towards instruction in which aid is given:—

Subject 1, Practical Plane and Solid Geometry.
" 2, Machine Construction and Drawing.
" 3, Building Construction *or* Naval Architecture and Drawing.
" 4, Elementary Mathematics.
" 5, Higher Mathematics.
" 6, Theoretical Mechanics.
" 7, Applied Mechanics.
" 8, Acoustics, Light, and Heat.
" 9, Magnetism and Electricity.
" 10, Inorganic Chemistry.
" 11, Organic Chemistry.
" 12, Geology.
" 13, Mineralogy.
" 14, Animal Physiology.
" 15, Zoology.
" 16, Vegetable Anatomy and Physiology.
" 17, Systematic and Economic Botany.
" 18, Mining.
" 19, Metallurgy.
" 20, Navigation.
" 21, Nautical Astronomy.
" 22, Steam.
" 23, Physical Geography.

VII. The assistance granted by the Science and Art Department is in the form of—

1. Public examinations, in which Queen's Medals and Queen's Prizes are awarded, held at all places complying with certain conditions.
2. Payments on results to teachers.
3. Scholarships and Exhibitions (see p. 13).
4. *Building Grants.*
5. Grants towards the purchase of apparatus, &c. (See § XXXV.)

VIII. Suitable premises, with firing, lighting, &c., must be found and maintained at the cost of the locality where the school or class is held. If at any time the funds do not cover these requisite local expenses, it must be inferred that there is no such demand as the Government is justified in aiding, for instruction in the locality; and the assistance of the Department will be withdrawn (*see* Building Grants § XXXIV.). **School Premises.**

IX. A Local Committee of Management of not less than five well known responsible persons must be formed in connexion with every Science Class, who will carry out the instructions contained in the Appendix. Instructions for a Committee when payments are to be claimed are given at p. 23, for a Committee of a class which merely desires examination at p. 26. **Local Committee.**

Examinations.

X. The Science and Art Department holds annually about May, through the agency of the Local Committees, public examination in all the before-mentioned Sciences in any place in the United Kingdom which complies with the requisite conditions. (§§ VIII. and IX.) **Examination of Classes.**

XI. The examinations are of two kinds, but held on the same evening and conducted by the same Committee.

a. The class examinations for students under instruction in Science Classes whether taught by teachers qualified to earn payments on results or not.

b. The honours examination, of a highly advanced character.

The class examination is of two grades or stages; the first stage or elementary examination, and the second stage or advanced examination. On this examination the payments on results and prizes, &c. are awarded as specified in §§ XVIII., XIX., and XXIII.

XII. Application for examination must be made on Science Form No. 119 before the end of March, stating the number of persons and the subject or subjects in which they are to be examined.

Navigation Schools.

XIII. In addition to the above, class examinations are held in Mathematics, Navigation, Nautical Astronomy, Steam, and Physical Geography for the benefit of sea-faring men—and for them only—three times a year in all seaports where Local Committees are formed and are willing to undertake them. These examinations take place in the beginning of March, September, and December. The application for these examinations must be made on Science Form No. 119 before the 10th day of the previous month.

Re-examination.

XIV. If at any time there be reason to suspect the fairness of the examination generally, or of the way in which particular candidates have worked their papers, a further examination will take place in such manner as may be deemed most advisable. Refusal on the part of any candidate to answer will entail the cancelling of his previous examination.

Amalgamation of Classes and Committees.

XV. If two or more classes in the same town, or within a reasonable distance of one another, apply for the examination of the Science and Art Department, a general examination committee must be formed by the amalgamation of the several Committees to carry out the examinations at some common centre, such as the town hall or other public building. It is only when the classes consist of 50 or more candidates that such amalgamation of the Committees will not at present be insisted on.

Examination of external Students.

XVI. Besides the registered students of a class, any other person may present himself for examination before the Local Committee whenever an examination is being held for the class. He must apply to the Local Secretary before the 26th of March, and if required by the Local Committee, pay a registration fee of not more than 2*s*. 6*d*. Arrangements must therefore be made by the Local Committee, or the General Examination Committee, as the case may be, to enable other candidate,

besides the students in the class for which the Committee act, to sit at the examination. The registration fee of 2*s*. 6*d*., which such candidates may be required to pay, is to reimburse the Committee for any extra expenses incurred by such attendance, and may at their option be remitted.

XVII. At the May class examinations and the quarterly examinations of seamen the grades of success are:—in the first stage or elementary paper, first, second, and third class; and in the second stage or advanced paper, first and second class. For the third or lowest class the standard of attainment is only such as will justify the Examiner in reporting that the instruction has been sound, and that the students have benefited by it. The standard may be raised from year to year. **Classification of Results of class examinations.**

XVIII. To all successful students are given printed lists of results showing their position; to the first class in both stages are given Queen's prizes, consisting of books or instruments chosen by the candidates from lists furnished for that purpose.* **Queen's Prizes.**

These are unlimited in number, and are open to all candidates who come within either of the following categories, (1) Students in Science Classes under Teachers qualified to earn payment; (2) Registered Students in Artisan Classes taught by other Teachers.

Other candidates, if successful, only receive Cards of merit.

The following are exceptions to the above rule:—

a. Teachers earning or who have earned payments on the results of instruction; and

b. Students who have previously received the same, or a higher class, in the same subject.

XIX. Four medals, one gold, one silver, and two bronze, are given in the class examination in each subject for competition among the bonâ fide students of Science Classes who either come within the category of persons on account of whom payments can be earned or are under 17 years of age. **Queen's Medals.**

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* Candidates who have obtained a first or second class in the advanced stage may obtain tickets of admission to the Educational and Art Libraries on application, by letter, addressed to the Secretary.

Only registered students of schools and classes under Local Committees (see § IX.) are eligible for medals. They cannot be taken by middle class students who are more than 17 years of age nor by persons engaged in teaching even if qualified as above. Should a student take more than one gold, silver, or bronze medal, he will receive books instead.

Payments on Results.

Qualification.

XX. Persons are qualified to earn payments on results who have:—

a. obtained certificates as teachers in any of the before-mentioned sciences according to the rules in force previous to January 1867, or,

b. obtained a First or Second Class in the advanced paper at the May class examination since that date, or,

c. taken honours at the May examination.

No payments are made to a teacher on account of instruction given in subjects in which he is not so qualified.*

To whom made.

XXI. Payments on results are made either directly to teachers or to the Committee or managers of the school. Where classes are formed by a teacher incidentally, in addition to his regular duties, the payment may be made directly to him. Where there is a regularly organised Science School, with day, or day and evening classes in science, the payments will be made to the Committee. The question of a school claiming under this last head will be specially considered by the Department.

XXII. Payments are only made to the teacher or to the Committee on condition that the student has

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* Such examination will be dispensed with in the case of a candidate who has taken a degree at any University of the United Kingdom, or who has obtained the Associateship of the Royal School of Mines, London, or the Royal College of Science, Ireland. Full particulars must be furnished by the applicant, accompanied by his diploma or a certificate from the Registrar of his University. This action must have been taken and the applicant recognised by the Department before payments on results can be claimed.

received 25 lessons* at least from the teacher or teachers in each subject in which payment is claimed since the last examination, each lesson being an attendance at a meeting of the school of at least three-quarters of an hour's duration on a separate day. The 25 lessons need not necessarily be all given in one year, but may extend over a longer period.

XXIII. Payments are made to the qualified teacher on account of the instruction of students of the Artisan Classes (for definition of Artisan Class *see* Science Form No. 51, page 28) in the following manner:—The payments claimable for each student in each subject are—3*l.* for a first class in the elementary stage, 2*l.* for a second class, and 1*l.* for a third class, and a further payment of 2*l.* for a first class and 1*l.* for a second class in the advanced stage, provided the student has in a previous year passed in the elementary stage;† but these amounts are reduced in the following ways:‡ **Payments to Teachers.**

1st. If the student has been previously successful in the same stage of the same subject, such payments are

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* It must be clearly understood that the number (25) of lessons which the teacher is required to give is the minimum fixed as a criterion that the pupil has received his instruction from the teacher. It is not meant in any way to specify that that amount of instruction is sufficient, or to guarantee the teacher's receiving payment, if that amount of instruction alone is given.

† Students who have already, 1868, passed are considered as satisfying this condition, and payments will be made on their account according to the old rules, on the assumption that the First and Second Class in the advanced stage represent the former first and second class, and that the first, second, and third class in the elementary stage represent the former third, fourth, and fifth class. Thus if a student who has already taken a fourth class should at the next examination take a second class in the advanced stage, the teacher will receive 2*l.* on his account.

‡ This rule will be modified in the case of teachers who, at the Examination in May 1869, are bonâ fide passing for and intend at once to become Science Teachers. The proviso that the student shall first pass in the elementary stage before passing in the advanced will not be obligatory in their case, and the Science Teacher who has instructed them will be allowed to earn full payment on their account—up to a maximum that is of 5*l.* for a first class in the advanced stage.

reduced by the normal payment which was claimable on such previous success; for instance, the 2*l.* payment for a second class in the first stage would, if the student had previously taken a third class, be reduced by 1*l.**

2nd. When on this scale they would amount to more than 60*l.* the excess up to 40*l.* is diminished by one quarter, the excess above 40*l.* by one half. Thus payments which on the above scale would be 100*l.* and 150*l.* will be reduced to 90*l.* and 115*l.* respectively.† If the teacher be instructing classes three miles or more apart this deduction will be reduced by the amount of his travelling expenses.

Payment to Committee.

XXIV. Payments are made to the Committees on the same scale as that given in § XXIII. with the exception of the reductions described in the last paragraph (XXIII. 2nd.) which do not apply, but no payment of more than 15*l.* will be made on account of any one student, nor will the total payment to the school exceed a maximum of 2*l.* per successful paper worked at the examination by artisan students taught during the preceding year.

These payments may be divided in any proportion the Committee think fit among the teachers of the school, and a proportion not exceeding 20 per cent., nor exceeding the local voluntary contribution to the expenses of the school, may be deducted by the Committee in aid of such expenses.

Form of Claim for Payment.

XXV. The claim for the payments must be made on Science Form No. 51, or Science Form No. 51*a*. The voucher must be signed by the secretary or chairman and two members of the Committee at least, at a meeting of the Committee held specially for the examination and certification of the claim. (See Appendix, page 28.)

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* Deductions will be made in payments on account of Subject I. to the amount of any payments that have been made on Second Grade Examinations in Art, in practical geometry, perspective or mechanical drawing.

† Thus, 100, that is 60+40, is reduced to $60+40-\frac{1}{4}$ of 40 $=60+30=90$. 150, that is, $60+40+50$ is reduced to $60+30+25=115$.

XXVI. A school register must be kept in each subject on a Form which will be supplied on application. This must be made up from day to day, and will be examined and approved by the Inspector on his visit. It must be sent to the Department with the claim for payment, and no payment can be made unless the register is properly kept. School Register.

XXVII. All payments to qualified teachers on account of Science teaching are made by the Science and Art Department, and are only made in respect of a school in connexion with the Science and Art Department. No such payments are made in respect of any instruction in Science that may be given during the three attendances of an Elementary School receiving aid from the Educational Department, Whitehall. Instruction in an Elementary School.

XXVIII. These grants are only made while the teacher is giving instruction in a day or evening school or class for the industrial classes (adults or boys), approved by the Science and Art Department, and open at any time to the visit and inspection of its officers. The Managers of an Elementary School under the Inspection of the Education Department can permit their premises to be used for Science teaching, provided that no interference be allowed with the primary purposes of such Elementary School, or in any way with the three attendances of the Elementary School. Use of Elementary School Premises.

Scholarships and Exhibitions.

XXIX. The detailed rules are given at p. 18. These provide for two forms of scholarship in connection with elementary schools whether receiving State aid, as such, or not. The first of these is the elementary school scholarship. 5*l*. are granted to the managers of any elementary school for the support of a deserving pupil if they undertake to support him for a year and subscribe 5*l*. for that purpose. One such scholarship is allowed per 100 pupils in the school. The selection of the pupil for the scholarship is to be by competition; the details of this, however, the managers of the school may arrange as they please, subject to the approval of the Science and Art Department. The payment of 5*l*. by the Science and Art Department is made conditional on the scholar passing in a branch of science at the May examination. Elementary Schools' Scholarships.

Science and Art Scholarships.

XXX. The second, a more advanced scholarship, is "the Science and Art Scholarship," of which, again, there may be one per 100 pupils. The Science and Art Department makes grants of 10*l.* towards the maintenance for one year of the most deserving pupil or pupils in an elementary school who may have taken a first grade in elementary Geometry and Freehand or Model Drawing,* and passed in some branch of Science, *provided that the managers of the school undertake to support him for one year, and subscribe 5l. for that purpose,* on condition that at the end of the year the scholar obtains at least a first class in the elementary stage in the subject of science in which he originally passed, or passes in some other subject.† In both these cases the scholar must be from 12 to 16 years of age.

Local Exhibitions.

XXXI. Thirdly for advanced scientific instruction, the Minute offers local exhibitions to enable students to complete their education at some college or school where scientific instruction of an advanced character may be obtained. The Science and Art Department will make a grant of 25*l.* per annum, for one, two, or three years for this porpose when the locality raises a like sum by voluntary subscriptions. And if the student attend a State school, such as the Royal School of Mines in London, the Royal College of Chemistry in London, or Royal College of Science in Ireland, the fees are remitted. It is a condition that the Exhibition is awarded in competition, the branch or branches of science for which may be fixed by the locality, and that the student pursues his studies satisfactorily (*see* p. 19).

XXXII. Royal Exhibitions, of the value of 50*l.* per annum tenable for three years, to the Royal School of Mines, London, and the Royal College of

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* *The examination in drawing can, where there is no Art Certificated Teacher, be held by the Science Class Committee, to whom the necessary papers will be sent.*

† After May 1869 this condition will be:—passes in the advanced or second grade paper.

Science, Dublin (*see* pp. 20, 21) are given in competition at the May examinations.

XXXIII. Whitworth scholarships of the value of 100*l.* per annum, tenable for two or three years, are also given in competition at the May examinations. The special conditions which have been framed for these can be obtained on application.

Building Grants.

XXXIV. A grant in aid of a new building, or for the adaptation of an existing building, for a school of Science may be made at a rate not exceeding 2*s.* 6*d.* per square foot of internal area, up to a maximum of 500*l.* for any one school, provided that the school—

a. be built under the Public Libraries Act (13 & 14 Vict. c. 65.; 18 & 19 Vict. c. 70.; 29 & 30 Vict. c. 114.); or—

b. be built in connexion with a School of Art aided by a Department building grant.

And provided that there is a population in the neighbourhood which requires a School of Science; that it is likely to be maintained in a state of efficiency; and that the site, plans, estimates, specifications, title, and trust deeds are satisfactory.

Apparatus Grants.

XXXV. A grant towards the purchase of apparatus, diagrams, &c., of 50 per cent. on the cost of them, is made to Science Schools and Classes in Mechanics' and similar institutions with a properly constituted Committee (see § IX.). A requisition must in these cases be made on Science Form No. 49. (See page 31). **Grants for Apparatus.**

Teachers' Visits to London.

XXXVI. Science teachers who have taught two years consecutively and passed not less than 30 students each year, are allowed 2nd class railway fare and 3*l.* towards their expenses while living in London for the purpose of visiting the South Ken-

sington Museum and other Metropolitan institutions, in order that they may acquire for the benefit of their students a knowledge of the latest progress in those educational subjects which affect the schools, on condition that they remain there five days at least (see form of application).

N.B.—On the next page will be found a table of memoranda for the use of Secretaries and Members of Science Committees (Science Form, No. 170) *which it is expected will be carefully attended to.* This, as well as the other Forms given in the Directory, can be had on application to the Secretary, Science and Art Department.

APPENDIX.

APPENDIX.

SCIENCE FORM, No. 170.

MEMORANDA FOR THE USE OF SECRETARIES AND MEMBERS OF SCIENCE COMMITTEES.

Dates.	
1st November -	Form No. 120. The Report informing the Department of the existence of a school must be carefully filled in and sent immediately on its opening, or if it be an old school, on its re-assembling after the vacation. This must be accompanied or closely followed by Form No. 88, forming the Committee, or No. 168, continuing a Committee.
Constantly - - -	To visit the School and see that the Register is kept from day to day, and that everything is regular.
Before 31st March	To send Form No. 119 applying for examination in May.
Before 19th April -	To see that Form No. 91 is hung up in the School-room.
On the 21st April	If a parcel containing (1) the papers for the candidates to work upon, (2) copies of Form No. 91, one for each day's examination, and (3) envelopes in which to return the worked papers, should not have been received, or if there should be any mistake in the numbers sent for each subject as applied for, or in the covering letter, to communicate *at once* to the Department.
During the May examinations.	The examination papers for each evening will leave London by the night mail two evenings before, *i.e.*, Thursday evening papers will leave on Tuesday evening, Friday's on Wednesday evening, etc. Should they not arrive accordingly, a telegram to be sent *at once* to the Department.
On the evening of examination.	The candidates, being all seated at 6.50, to read out the rules on Form No. 91, then give out the papers to be worked on. Then at 6.55 to break the seal of the examination papers and distribute to the candidates. To adhere rigidly to the rules on Form No. 91. To sign Form No. 91. To seal up the papers in one of the envelopes provided and at once post them.
After the May examinations.	On receiving lists of the results to give one copy to each candidate whose name appears in it as being successful; to inform the others they have failed.
	To return Form No. 161 filled up as soon as possible in strict accordance with the rules on Form No. 110. (Prize List). To examine and certify Teacher's claims for payment, Form No. 51, and the School Register, which must be sent up at the same time. To return Form No. 108.

SCHOLARSHIPS AND EXHIBITIONS.

Minute of 21st December 1867, as modified by Minute of 16th January 1869.

My Lords consider the subject of scientific instruction with a view to its further encouragement and diffusion.

1. They refer to the Science Directory of the Science and Art Department, and to the Minute of the Education Department of the 20th February 1867, making additional grants for secular instruction to elementary schools.

2. In order to assist the artizan classes who may show an aptitude for scientific instruction, my Lords resolve to aid local efforts in founding scholarships and exhibitions. The scholarship is intended to maintain the student while remaining at the elementary school, and the exhibition to support him while pursuing his studies at some central institution where the instruction is of a high grade.

3. *Local Scholarships.*—These are of two kinds, the Elementary School Scholarship and the Science and Art Scholarship.

4. *Elementary School Scholarships.*—The Science and Art Department will make a grant of 5*l.* towards the maintenance of a deserving student to the managers of any elementary school who undertake to support him for one year and subscribe also at least 5*l.* for that purpose.

5. *Conditions.*—

a. With any number of scholars up to 100 on the register of the school there can be but one such Scholarship; above 100 and up to 200 two Scholarships, and so on for each 100.

b. The Scholarship or Scholarships must be awarded in competition to the most successful student or students in some examination of the school. The absolute terms of the competition and the award of the Scholarship will be left to the managers of the school, subject to the approval of the Science and Art Department.

c. The scholar must be an artizan or poor student as defined by the Science Directory, and be between 12 and 16 years of age.

d. He must not be the teacher, pupil-teacher, or other paid servant of a school.

e. He must continue regularly to attend the day school, and—

f. Obtain at least a third class in the elementary stage in some one or more branches of science at the succeeding May examination of the Science and Art Department, after which the Department grant of 5*l.* will be paid.

6. These grants will be made from year to year on the condition that the student each year pass in a new subject or in a higher grade of the same subject in which he first passed. It will be for the locality to determine for how many years the student may hold the scholarship, but in no case can he be allowed to hold it for more than three years.

7. The Science and Art Department will hereafter consider such alterations in these conditions as appear necessary.

8. *The Science and Art Scholarships.*—The Science and Art Department will make a grant of 10*l.* towards the maintenance of a student at an elementary school who has taken a first grade in Freehand or Model Drawing and Elementary Geometry (*see* Art Directory), and passed in one of the subjects of Science, *provided that the managers of the school undertake to support him for one year and subscribe 5l. for that purpose.*

9. *Conditions.*—

a. With any number of scholars up to 100 on the register of the school there can be but one such Scholarship; above 100 and up to 200 two Scholarships, and so on for each 100 scholars.

b. The Scholarship or Scholarships will be awarded to the most successful student or students in the school.

c. The scholar must be an artizan or poor student as defined by the Science Directory, of between 12 and 16 years of age.

d. He must not be the holder of an Elementary School Scholarship, the teacher, pupil-teacher, or other paid servant of a school.

e. He must continue regularly to attend the day school, and—

f. Obtain at least a first class in the elementary stage of the subject of Science in which he has already passed, or pass in some other subject.

g. In each year of holding the Scholarship he must pass either in a higher grade of the same subject or in a new subject.

10. *Local Exhibitions*.—The Science and Art Department will make a grant of 25*l*. per annum to the Managers of any school or educational institution, or any Local Committee formed for the purpose, who will raise the like sum by voluntary contribution for the maintenance of a student at some college or school where scientific instruction of an advanced character may be obtained. The exhibition may last for one, two, or three years.

11. *Conditions*.—

a. The exhibition must be awarded in competition in one or more branches of science at the May examination of the Science and Art Department. The managers may select any branch or branches of science for the competition, and if more than one be taken they may fix any relative amount of marks they consider best to assign to them.

b. The place where the student is to pursue his studies may be fixed by the managers subject to the approval of the Science and Art Department. If a Government institution be selected, such as the Royal School of Mines or Royal College of Chemistry, London, or the Royal College of Science, Dublin, the fees of the student will be remitted.

c. The exhibitioner must be of the artizan class or a poor student, as defined by the Science Directory.

d. The grant of the Department will be paid from year to year on condition that a like payment has been made by the managers or Local Committee, and that the student has pursued his studies satisfactorily according to regulations fixed by the Department.

12. Transmit a copy to the Treasury and request sanction to provide in the estimate for the increased expenditure likely to be occasioned by this Minute.

NOTE.—By elementary school is understood any school where elementary instruction is given, whether aided by the State or not.

Localities wishing to apply for these scholarships and exhibitions should write for the following forms :—

For a	Local scholarship	Nos. 280, 281, 282.
„	Science and Art scholarship	Nos. 283, 284, 285.
„	Local exhibition	Nos. 286, 287, 288.

The first form in each case should be returned filled up by the 1st May.

EXHIBITIONS AND FREE ADMISSIONS AT THE ROYAL SCHOOL OF MINES, LONDON, AND THE ROYAL COLLEGE OF SCIENCE, DUBLIN.

Royal Exhibitions.

1. There are nine Royal Exhibitions to the Royal School of Mines, Jermyn Street, and nine to the Royal College of Science, Dublin, of the value of 50*l.* per annum each, entitling the holders to free admissions to all the lectures, and to the Chemical and Metallurgical Laboratories at those two Institutions, to be held from year to year for three years, on the condition that the holder attends the lectures regularly during those years, and passes the examinations required for the associateship of the School.

At the May 1869 examination six of the above Royal Exhibitions, viz., three to the Royal School of Mines, and three to the Royal College of Science, will be open for competition independently of the prizes, &c. offered by the Science and Art Department.

All persons over 21 years of age, excepting artisans, and such as come within the category of persons paid upon under the Science Directory, will be excluded from competing for the Royal Exhibitions. Special cases, however, must be determined according to the spirit of the rules, and the object of the endowment.

The competition for the Royal Exhibitions will be determined by affixing the following values to the several results of the May examination, viz. :—

	Marks.
For 3rd class in Elementary Stage	1
For 2nd " " "	3
For 1st " " "	5
For 2nd " in Advanced Stage	5
If previously successful in Elementary Stage	7
For 1st class in Advanced Stage	7
If previously successful in Elementary Stage	9
And in addition to the first five in the 1st class in Advanced Stage 5, 4, 3, 2, and 1 marks, if more than 90 per cent. of marks have been obtained.	
For honours—	
2nd class	14
1st class	17

But no candidate will be allowed to take an Exhibition who has not obtained at least a 1st class in the Elementary Stage in Elementary Mathematics.

Free Admissions.

2. Free admissions to the lectures at the Royal School of Mines, Jermyn Street, or the Royal College of Science, Dublin, are granted to any person who takes a gold medal in the May examination.

FORM of APPLICATION for the ROYAL EXHIBITIONS to the ROYAL SCHOOL OF MINES, Jermyn Street, London, and the ROYAL COLLEGE OF SCIENCE, Dublin.

______________________________Name of School.

We the undersigned hereby certify that____________________who was a candidate at the recent May Examination for the Royal Exhibitions at the Royal School of Mines, and the Royal College of Science*, Dublin, obtained the following successes:—

and that he is fairly described as under—

1. Under 21 years of age:— or,
2. An artisan or operative in the receipt of weekly wages, supporting himself by his own manual labour, or the child of such not earning his own livelihood:—or,
3. Although not an artisan, yet such as may fairly be considered as belonging to the industrial classes, as coming within one of following categories, or being the child of one who does.

a. Though paid at longer intervals than a week still supporting himself by his own manual labour and not by profit on the labour of others, that is, not employing apprentices, journeymen, etc.

b. Though not supporting himself by manual labour, yet being of the *same means and social level* as those who do so, (such as shopkeepers who have only petty stocks and employ no one but members of their own family,) policemen, coast-guards, etc.

c. Though not supporting himself by manual labour, yet such as it would be unreasonable to expect to pay the fee of middle class students, as some description of clerks, shopmen, etc., and we certify that they or—in case they are not earning their own livelihood—their fathers are not assessed to the income tax.

4. That he is entitled to be considered as a special case on the following grounds:—

____________________ *Chairman or Secretary.*

____
____________________ *Two members of the Committee.*

* After each name must be stated all the successes of the candidate at the May Examinations.

SCIENCE FORM, No. 88.

LOCAL COMMITTEES FOR SCIENCE SCHOOLS AND CLASSES.

1. A Local Committee of not less than five *well-known* responsible persons must be formed in connexion with every Science class, in order to comply with the necessary requirements of the Science and Art Department, and to carry out various arrangements on its behalf necessary for testing the efficiency of the science instruction, on the proof of which alone the aid of the Department is given.

2. The gentlemen proposed to act on this Committee are to fill in the form on the next page, stating their willingness to carry out the necessary arrangements for examinations, &c., and giving the address and occupation of each member.

3. The relation of the Committee to the teacher of a Science school or class will vary much according to the varying circumstances of different localities. With this and other local arrangements the Science and Art Department does not interfere, but leaves them to the locality to settle.

4. The Science and Art Department requires that the Local Committee shall—

a. Be responsible for the safe custody of all apparatus towards the purchase of which the Department has paid 50 per cent.

b. Provide a room or rooms of sufficient size to carry out the annual examination according to the detailed regulations under that head. This examination is of *all* persons who wish to present themselves, and not only of those taught by the qualified teacher; but those persons who are not taught by the qualified teacher must send in their names before the 26th March, and may be required to pay a registration fee of *2s. 6d.* for the whole examination.

c. See that a school register, showing the attendance, number of lessons, payment of fees, &c., on an approved form, be kept properly filled up, and sent to the Science and Art Department when required.

d. Send to the Secretary of the Science and Art Department the list of students to be examined, before the end of March, specifying the subjects in which they are to be examined. That they shall be responsible for conducting and superintending the examination; giving out the examination papers which will be sent for that purpose: seeing them worked fairly and certifying to the same, not less than three of the Committee being always present: and sending the worked papers, under seal, by the day's post to the Secretary of the Science and Art Department.

e. Certify, firstly, that those students on whose examination the teacher bases his claim to payments on results, are artizans or operatives, or their children, or can claim as such (see Science Form, No. 51); and, secondly, that they have received 25 lessons at least from the teacher in the year or since the last examination, on their passing at which payment was claimed on their account.

5. The Science school or class must be at all times open to the visit and inspection of the officers of the Science and Art Department as a condition to the grant of aid from it; if at any time it is found that the apparatus, &c., towards the purchase of which a grant has been made is not properly taken care of, or that a proper room with firing, lighting, &c., is not provided for the class, the aid of the Department will be withdrawn.

FORM of APPLICATION to act as a COMMITTEE for a SCIENCE SCHOOL or CLASS.

We the undersigned,

[*f*. The Committee shall be composed entirely of well-known responsible persons of position who are quite independent of the school or class, and who have no such personal interest in it as can lay them open to the slightest suspicion of partiality; and of course no member should be connected with the Teacher, have any pupils for examination, or be a pupil himself.

g. It is very desirable that as many persons as possible in recognised positions of public responsibility in the district, such as Magistrates, Municipal Authorities (Mayor, Aldermen, or Town Councillors), Heads of Educational Establishments (Trustees of Grammar Schools, Managers of National Schools), Clergymen, &c., should be on the Committee.

h. It is absolutely necessary that at least two such responsible persons should agree to act.

i. The Committee must consist of a Chairman, Secretary, and at least three other Members.

k. The Chairman must be a Magistrate, Mayor, Boroughreeve, Provost, or Alderman, or other public officer of recognized position, Trustee of Grammar School, or Clergyman of the Established Church in parochial employment.

l. The Chairman of the Committee will inform My Lords as to the constitution of the Committee being in accordance with these requirements.

m. The Secretary of the Committee of the Science School or Class, as being the medium of communication, will carry on all correspondence with the Science and Art Department, and is held responsible for making out and sending all returns required, for the receipt and distribution of the examination papers, the transmission of the worked papers, &c., at the proper times according to the regulations; and in consequence of the necessary demands on his time and trouble My Lords have sanctioned, provisionally, the payment to him of the following fees :—1*l*. annually for furnishing the returns, &c. specified on Science Form, No. 170, connected with any Science school or class, and 1*l*. in addition for each day's examination held by the Committee to which he is Secretary. The Secretary must be a member of the Committee; the requirements in par. 1 apply equally to him.

n. This form is to be filled in and returned to the Department annually immediately on the re-assembling of the class after the summer vacation, except in the case of new schools or classes, when it should be made as soon as they are formed.]

propose to act as the Local Committee for the Science Class held at

____

and taught by ________________________________

We undertake for the year   at least, and further till another Committee satisfactory to the Science and Art Department has been appointed,

1. To be responsible for the safe custody of all the Apparatus, Diagrams, &c., towards the purchase of which the Department has in any way contributed.

2. That three or more of our number will be ready at the appointed time to be present at, and superintend, the examinations of the Science Class according to the instructions of the Science and Art Department, and give the teacher the necessary vouchers.

3. That a room or rooms shall be provided for the due carrying out of such examination, according to the rules of the Department, providing sufficient space for the examination, not only of all persons taught by

the certificated teacher, but of all others who may wish to attend the examination.

(A fee of not more than 2*s.* 6*d.* may be charged on each applicant for examination who is not a student in the class, to reimburse the Committee in any extra expenses they may be put to in providing a room).

4. That the School or Class shall be open at any time to the visit and inspection of the Officers of the Science and Art Department.

NOTE.—The school or class will be inspected periodically by an officer of the Science and Art Department, who will report whether the regulations be strictly carried out. At his visit, of which due notice will be given, a meeting of the Committee must be held to receive him, at which as many of the members as possible are expected to attend.

SIGNATURE.	ADDRESS.	Occupation, specially stating how fulfilling the conditions of "*g.*" and "*k.*" above.
NOTE.—On the formation of Committees this form should be signed at a general meeting.		
______ *Chairman.*		
______ *Secretary.*		

I certify that this Committee complies with the requirements of the rules *f*, *g*, *h*, *i*, and *k*.

______

Chairman.

The Secretary,
Science and Art Department.

This form may be had on application to the Secretary, Science and Art Department, South Kensington.

SCIENCE FORM, No. 168.

Where the same Committee proposes to act again it will not be necessary to re-sign the above, No. 88, but only to hold a meeting and fill up this form, No. 168, which may be had on application.

SCIENCE FORM, No. 88 *a*.

LOCAL COMMITTEES FOR SCIENCE SCHOOLS AND CLASSES NOT RECEIVING AID FROM BUT EXAMINED BY THE SCIENCE AND ART DEPARTMENT.

This Form is a modification of the previous, No. 88., and may be had on application to the Secretary, Science and Art Department, South Kensington.

SCIENCE FORM, No. 120.

SCIENCE CLASSES UNDER TEACHERS QUALIFIED TO EARN PAYMENTS.

ANNUAL REPORT OF SCIENCE SCHOOL OR CLASS,

To be made on its establishment, and annually immediately on the re-assembling of the class after the summer vacation.

In all cases this form must be sent in before the 1st November.

Name of Town ______________________

Place, as Mechanics' Institution, &c., in which the Classes are held ______

Name of Street, No., &c. ______________________

Name of Teacher or Teachers ______________________

Their private addresses ______________________

Total No. of individual Students ______________

(If a student attends two or more classes he must only be counted as one student.)

CLASSES IN (state subject).	Fees.	No. of Students.	Days on which they meet.	Hours of Meeting.	Period of the Year during which the Classes continue.

SCIENCE FORM, No. 119.

APPLICATION FROM ——— SCIENCE SCHOOL FOR EXAMINATION IN MAY.

To be sent to the Secretary of the Science and Art Department before the end of March.

	I. Practical, Plane, and Solid Geometry.	II. Mechanical and Machine Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Physiology and Economic Botany.	XVII. Systematic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. General Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Number of students under instruction during the year - - - - - -																							
Number intending to present themselves for examination - In honours - -																							
In the advanced paper -																							
In the elementary paper -																							
Number intending to present themselves for examination not belonging to the class - - - In honours - -																							
In the advanced paper -																							
In the elementary paper -																							

Total number of students * under instruction during the year ___________

Total number of students * intending to present themselves for examination ___________

Name of place where the examination is to be held. Name and address of the person to whom the examination papers are to be sent.

N.B.—The address must be that to which the *Examination papers* are to be sent.

Specify here the arrangements which have been made in accordance with § XIII. of the Science Directory to conduc tthe examination of any other classes in the town (if there be any) at the same centre.

* The total number of *individual* students only should be here given, so that if one student attends two or more classes he must only be counted as *one*.

SCIENCE FORM, No. 51.

SCIENCE AND ART DEPARTMENT OF THE COMMITTEE OF COUNCIL ON EDUCATION, SOUTH KENSINGTON.

Application from _______________ *Science Teacher in* ____________ *School or Institution at* _____________________ *for payment.*

On behalf of the Committee of Management of this School, We do hereby certify :—

(1.) That Mr. _________________ has duly performed the various duties devolving upon him as a Science Teacher in the School, during the ________ ending ______ day of ________________ 186 .

(2.) That he has given the following Students at least 25 lessons during the year, or since the last examination at which payment was claimed on their account, in each subject for which payment is claimed.

(3.) That the under-mentioned students are *artizans or operatives* * *in the receipt of weekly wages, supporting themselves by their own manual labour; or their children not earning their own livelihood.*

Examined and certified at a meeting of the Committee held for that purpose at ____ on ____ day of ____

______________________ Secretary.

______________________ }
______________________ } Two members of Committee.

I hereby certify that the following particulars are correct.

______________________ Teacher.

State how qualified to earn payment.

NAMES OF PASSED *ARTIZAN OR OPERATIVE* STUDENTS.*

N.B.—The names of the students must be arranged alphabetically. After each student's name must be placed his several successes (if he has more than one); and in the last column the amount claimed on each success after making the proper deductions.

Surname.	Christian Name in full.	Age last Birthday.	Trade, or father's trade. (State which is given).	Position at the late Examination. Subject.	Class.	Highest Position in same Subject at any previous Examination.	Payment claimed.
&c.							

* Should the Teacher have instructed any Students who may fairly be considered to belong to the industrial classes, but whose wages are paid at longer intervals than a week, or who do not support themselves by their own manual labour, the claims on their account must be made by the Committee of the school on the form on page 3, when they wi be considered on their merits.

On behalf of the Committee of the School, We, the undersigned, beg leave to recommend that the Teacher, Mr. ____________________ be allowed to claim the allowances on the following students, whom we consider may fairly be taken as belonging to the industrial classes, as coming within one of the following categories, or being the children of such.

a. Though paid at longer intervals than a week, still supporting himself by his own manual labour and not by profit on the labour of others, that is not employing apprentices, journeymen, &c.

b. Though not supporting himself by manual labour, yet being of the *same means and social level* as those who do so, such as shopkeepers (who have only petty stocks and employ no one but members of their own family), policemen, coast-guards, &c.

c. Though not supporting himself by manual labour, yet such as it would be unreasonable to expect to pay the fee of middle class students, as some descriptions of clerks, shopmen, &c.

We certify to the best of our belief—

(1.) That he has given them (25) lessons at least during the year, or since the last examination at which payment was claimed on their account, in each subject for which payment is claimed.

(2.) That they, or—in case they are not earning their own livelihood—their fathers are not assessed to the income tax.

(3.) That the following particulars on which the Teacher grounds his application are correct.

Examined and Certified at the meeting of the Committee held for that purpose at _____ on _____ day of _____

____________________ Secretary.

____
____________________ } Two members of Committee.

I hereby certify that the following particulars are correct.

____________________ Teacher.

State how qualified to earn payment.

NAMES OF PASSED STUDENTS *CLAIMING AS INDUSTRIAL CLASSES.*

N.B.—The names of the students must be arranged alphabetically. After each student's name must be placed his several successes (if he has more than one); and in the last column the amount claimed on each success with the proper deductions.
Under the names of students in category "c" a line must be drawn.

Surname.	Christian Name in full.	Age last Birthday.	Trade, or father's trade. (State which is given).	Position at the late Examination.		Highest Position in same subject at any previous Examination.	State Category a, b, or c.	Payment claimed.
				Subject.	Class.			
&c.								

The Secretary,
Science and Art Department.

(The following particulars will be filled up at South Kensington.)

Examined and found correct to the extent of ____________________

________ day of ____________ 186

Approved ____________________ day of ____________ 186

[SPECIMEN.]

Science Form, No. 51.
South Kensington, July 1868.

SCIENCE AND ART DEPARTMENT OF THE COMMITTEE OF COUNCIL ON EDUCATION, SOUTH KENSINGTON.

Application from *John Smith,* Science Teacher in *the Science* School or Institution at *Midhurst* for payment.

On behalf of the Committee of Management of this School, We do hereby certify:—

(1.) That Mr. *J. Smith* has duly performed the various duties devolving upon him as a Science Teacher in the School, during the *year* ending 31*st* day of *May* 1868;

(2.) That he has given the following Students at least 25 lessons during the year, or since the last examination at which payment was claimed on their account, in each subject for which payment is claimed;

(3.) That the under-mentioned students are *artizans or operatives* in the receipt of weekly wages, supporting themselves by their own manual labour; or their children not earning their own livelihood.*

Examined and certified at a meeting of the Committee held for that purpose at the National Schoolroom on the 10th July 1868.

Wm. Brown, Secretary.

John Jones,
James Robinson, } Two members of Committee.

I hereby certify that the following particulars are correct.

John Smith, Teacher.

Teacher's Certificate in Subjects X. and XI., 1st Class in May 1867 in Subjects I. and XIV.

NAMES OF PASSED ARTIZAN OR OPERATIVE STUDENTS.*

N.B.—The names of the students must be arranged alphabetically. After each student's name must be placed his several successes (if he has more than one); and in the last column the amount claimed on each success after making the proper deduction.

Surname.	Christian Name in full.	Age last Birthday.	Trade, or father's trade. (State which is given).	Position at the late Examination. Subject.	Class.	Highest Position in same Subject at any previous Examination.	Payment claimed. £ s.
Adams,	*James,*	22	*Carpenter,*	*X.*	*1st*	—	5 0
"	"	"	"	*XI.*	*2nd*	*4th*	2 0
"	"	"	"	*XIV.*	*5th*	—	1 0
Barber,	*John Wm. Henry.*	14	*Butcher (f)*	*X.*	*1st*	*2nd*	1 0
"	"	"	"	*XI.*	*4th*	—	2 0
Smith,	*William,*	12	*Baker (f)*	*I.*	*1st*	—	5 0
							£16 0

* Should the Teacher have instructed any Students who may fairly be considered to belong to the industrial classes, but whose wages are paid at longer intervals than a week, or who do not support themselves by their own manual labour, the claims on their account must be made by the Committee of the school on the form on page 3, when they will be considered on their merits.

SCIENCE FORM, No. 108.

Application from ______________ Secretary of the Local Committee for the Science School or Class at ______________ for payment of allowance for duties connected with the School, and for superintending the examination.

SIR,

I hereby certify that I am entitled to a payment of ________ according to the regulations of the Science "Directory"* for duties connected with the Science Class at ______________ having † ______________ students under instruction, of whom ______________ were examined, and for superintending the arrangements for carrying out the examination on the undermentioned days in May, 186 , I request that the sum of £ ______________, being the authorized fee, may be paid to me.

Dates of Examination.	Dates of Examination.	Dates of Examination.
______	______	______
______	______	______
______	______	______
______	______	______
______	______	______
______	______	______

I am, SIR,
Your obedient Servant,

The Secretary,
Science and Art Department.

CONDITIONS UNDER WHICH APPARATUS, INSTRUMENTS, BOOKS, &C. MAY BE OBTAINED BY SCIENCE SCHOOLS OR CLASSES (TAUGHT BY A QUALIFIED SCIENCE TEACHER),‡ IN PUBLIC SCHOOLS, MECHANICS' INSTITUTIONS, &C.

1. The Lords of the Committee of Council on Education, having had under their consideration several applications from the managers and masters of Mechanics' and other Institutions, for grants to be made to them of Apparatus and Illustrations, recommended by the Science and Art Department for teaching science, think it necessary to adopt some general principle which shall regulate the decisions of the Committee in reference to such applications.

* £1 annually for furnishing the returns, &c. specified on Science Form No. 170, connected with any Science school or class; £1 in addition for each day's examination held by the Committee to which he acts as Secretary.

† As these numbers are required for returns to Parliament, care must be taken that the same individual is not counted twice if he happens to have been a Student, or to have come up for Examination, in more than one subject.

‡ Apparatus not exceeding 10*l.* in value may be obtained by poor Schools and Mechanics' Institutes, not taught by a qualified teacher, under the same conditions, that is, the Department will aid them to the extent of 5*l.*

Their Lordships have already fully recognized the great importance of practical science to all classes of the community, in all relations of life. They are, therefore, desirous that the Science and Art Department should assist, as far as possible, in promoting the distribution of diagrams and apparatus as the means of accomplishing this object; but as the indiscriminate gift of these aids for instruction to all applicants might lead to abuse, it is necessary to require some guarantee that they will be duly appreciated, which the mere request to have them does not imply.

The principle which governs the whole proceedings of the Department in all its branches is to afford partial aid, and to encourage, but not supersede public exertions in promoting education in science. They have, therefore, resolved that the Department shall have the power to assist schools and classes taught by a qualified teacher in Mechanics' and other institutions in purchasing diagrams and apparatus for teaching science at a reduction of 50 per cent. on the net cost.

Lists of the scientific diagrams and apparatus prepared by the Department, according to conditions of the following Minute, may be obtained of the Secretary of the Science and Art Department, South Kensington, London, W. It should be distinctly understood that the aid of the Department in purchasing these articles at a reduced price, if above 10*l.* in value, can be granted only to public schools and institutions when taught by a *duly qualified teacher*.

Minute of the 23rd March 1860.

"The Lords of the Committee of Council on Education desire to afford the greatest facilities to teachers of science and navigation schools in obtaining the best instruments, apparatus, &c., for giving instruction in science and navigation, towards the purchase of which the Science and Art Department is authorized to pay 50 per cent. of cost; and they consider that the fullest opportunities should be given to manufacturers in all parts of the Kingdom for supplying such apparatus, &c. At the same time it is necessary that the Science and Art Department should have some guarantee that the apparatus and instruments are of good quality, and moderate in price. My Lords have therefore laid down the following rules and conditions:—

"1. Samples of all articles on the manufacturer's list are to be sent to the Educational Collection, South Kensington Museum, for exhibition, where they will be arranged separately, according to the science for which they are intended, so as to afford teachers and others facility in inspecting them and making a choice.

"2. The manufacturer is to supply priced catalogues of such articles printed in demy 8vo., in order that the various catalogues may be bound up together and supplied when asked for.

"3. The manufacturer is to guarantee that the articles exhibited are fair samples of those specified in the priced catalogue, and he must engage to take back any article supplied to schools which may be inferior to the standard."

Manufacturers willing to comply with these conditions are to make a statement to that effect, and to send lists of apparatus, instruments, books, &c. in the following sciences:—1. Practical plane and descriptive geometry, mechanical and machine drawing, and building construction; 2. Physics (mechanical and experimental); 3. Chemistry; 4. Geology and mineralogy; 5. Natural history (zoology and botany, vegetable and animal physiology); 6. Navigation and nautical astronomy, and physical

geography. If these lists and prices are such as can be approved of, the manufacturer will be informed, and as soon as possible on his fulfilling the conditions, his list will be inserted in the catalogue. The catalogue will undergo a revision at least once a year, when manufacturers may send any improved forms of apparatus, &c.

The selection of the manufacturer will lie wholly with the Committee of the school. On their demand being sanctioned, the manufacturer will receive instructions to supply the articles upon his receiving the 50 per cent. due from the school.

On obtaining a receipt from the Committee of the school (which is included in the form of the requisition) that the articles have been received, the remaining 50 per cent. will be paid quarterly to the manufacturer by the Department.

2. Payments, including charge for packing, must be made in *advance* to the agents on receipt of the invoice. The goods to be sent at the *risk* of the purchaser.

All communications to be addressed to the Secretary of the Science and Art Department, South Kensington, London, W.

By Order of the
Committee of Council on Education.

N.B.—Apparatus grants will in future be rigorously confined to articles of a permanent and non-destructible nature; hence no aid will be afforded in the purchase of breakable articles, such as glass retorts, test tubes, &c., or, indeed, generally in the purchase of articles to be used by the student as distinguished from those of a permanent and illustrative character which are required by the teacher in giving instruction in science.

Grants are only made in the purchase of one object of the same kind. Duplicates of apparatus, &c. are not allowed at the reduced rate.

NOTE.—Schools requiring aid in the purchase of apparatus should apply for Form 49, and also the approved list of articles in the subject required.

SCIENCE FORM, No. 91.

Rules for the Conduct of Science Examinations.

1. The following rules must be hung up in the examination room for the information of the candidates one week before the examination. They should all be carefully read by the members of the Committee. Those marked with an asterisk must be read aloud before the Committee and the candidates on each night immediately before the examination begins.

2.* The candidates must be seated at least five feet apart, from centre to centre.

3.* All Diagrams, &c. must be removed from the walls of the examination room.

4. Ink and blotting paper must be provided by the committee. All arrangements for the accommodation of candidates should be completed by 6.30 p.m.

5. If one room is used, three of the Committee must be present during the whole of the examination, if more than one room then two of the Committee in each room,† who must carefully watch the whole examination and see that candidates use no unfair means either by assisting one another or using books or notes. The members of the Committee can, if they wish it, relieve one another, as long as the correct number are always present. No persons except members of the Committee are permitted to be present.

6. The examination papers will be forwarded, under cover, to the Secretary of the Committee so as to be received by him on the morning of the day before that fixed for the examination.

7.* The candidates should be in their places at 6.50 p.m. After this time no candidate must be admitted except under very exceptional circumstances, and by express permission of the Committee, and that *only* if no person has left the room who has seen the examination paper. No candidate must on any account be admitted after 7.30 p.m.

8.* The examination papers must be opened in the examination room in the presence of the Committee, at 6.55 p.m. No examination paper may be taken from the room till after 8 p.m.

9.* The blank papers supplied by the Department must be first distributed to each candidate, and the Committee should then see that the candidates commence by filling in their names, &c., where directed.

10.* Candidates should not bring anything with them into the examination room,‡ except pens and pencils. No scribbling paper, slates, or anything of that nature must be allowed.§ All books, note-books, &c. must be collected by the Committee. The retention of any book or notes by a candidate should lead to his immediate dismissal.

11.* Candidates must not on any pretence whatever speak to one another after the papers have been given out. If a candidate should require to ask a question, he will hold up his hand, when a member of the Committee will attend to him, but no question on the meaning of any portion of the examination paper must be asked or answered.

12. It may be of service to the Committee that the teacher of the

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† When there are not more than three candidates it will not be necessary for more than two members of the Committee to be present at the examination.

‡ Except such as by the Time Table (Science Form, No. 90) are required.

§ It is absolutely necessary that nothing that can be passed from one candidate to another should be allowed. Rough work and calculations must be done on the supplied form, the back of each leaf of the form, *i.e.*, pages 2, 4, 6, and 8, may be reserved for this purpose, the pen being drawn through to show that they are not for the examiner. ***But nothing must be torn off the form.***

class should attend before the examination begins to assist in getting the candidates into their places. He must not on any account be in the room after the examination papers are opened. Information of his having remained in the room after this will at once lead to the examination being declared null.

NOTE.—Should the teacher of the class wish to sit at the examination, he must apply specially to the Committee, so that they may arrange to have a table for him close to their own seats, and not with the other candidates.

13.* When the examination papers have been given out no candidate must be allowed to return after having once left the room.† On a candidate leaving the room his papers must be taken up.

14.* At 10 p.m., precisely‡, all the candidates' papers must be collected. It will therefore be advisable to warn them ten minutes before the time.

15.* The papers will be initialed, by the Committee as directed, as they are received from each candidate, as a guarantee that each has been worked by him whose name, &c. it bears. Should a candidate have completed his work before 10 p.m. he may, by permission of the Committee, go away at once, after his worked paper has been taken by a member of the Committee.

16.* Should a candidate break any of the foregoing rules, ask information from, or give information to, another, or use unfair means of any description, he must be at once expelled the examination room, and his paper cancelled, and the Committee will state on it the cause of his expulsion.

17. On these examinations depend large grants of public money. On their being fairly, honestly, and impartially carried out depends the continuance of the system. The Committees are intrusted with this duty. They will see, then, how necessary it is to be extremely careful in conducting the examinations, and to insist on the foregoing rules being complied with *to the letter*. They are therefore required to certify and forward this form with each set of worked papers.

We, the undersigned, members of the Committee of the Science School or Class held at ______________________________ hereby certify that we were present during the examination in ________ ________________ held in ________ rooms, in the ______________ on the evening of the __________________ where the accompanying papers were worked in our presence, and that the foregoing rules have been strictly complied with.

Dated this __________ day of ______________ 186 .

Signatures.	Time Present.	
	Hour of Arrival.	Hour of Departure.

† It will, therefore, be desirable to make some arrangements for the candidates to retire within the room.

‡ Except in the Drawing Examinations, subjects 1, 2, and 3, then the hour is 11 p.m.

SYLLABUS OF THE SUBJECTS IN WHICH EXAMINATIONS IN SCIENCE ARE HELD BY THE DEPARTMENT OF SCIENCE AND ART.

THE following Syllabus has been prepared in order to afford candidates some guide to their reading; but it must be understood that the questions in the examination need not necessarily be on the specific points enumerated.

The examination is by paper, but oral examination may be resorted to. The examination in each subject is distinct. Mention is made of text-books solely to afford a candidate some assistance in selection and a general idea of the scope of the examination, *and not at all to confine his reading to those works or to assert that they are the best on the subjects they treat of.*

A Course of Lectures as detailed below, on "Preparation for obtaining "Science Certificates and the Method of teaching a Science Class," has been delivered by direction of the Lords of the Committee of Council on Education. The lectures may be purchased, price 2*d*. each, at the book stall, South Kensington Museum, or on application by letter, enclosing postage stamps, to the Secretary, Department of Science and Art, South Kensington, London, W.

Geometrical Drawing, &c.	Prof. T. Bradley.
Mechanical Physics -	Rev. B. M. Cowie, M.A.
Experimental Physics -	Prof. Tyndall, F.R.S.
Chemistry - - -	Prof. Hofmann, F.R.S.
Geology - - -	Prof. Ramsay, F.R.S.
Mineralogy, &c. - -	Prof. W. W. Smyth, M.A., F.R.S.
Zoology - - -	Prof. Huxley, F.R.S.
Botany - - -	Edwin Lankester, M.D., F.R.S.
Navigation and Nautical Astronomy.	J. Riddle, F.R.A.S.
Physical Geography -	Dr. G. Kinkel, F.R.G.S.

A Second Course has been delivered, of which the following have been published:—

Lecture I. -	Vegetable Physiology and Economic Botany.	Edwin Lankester, M.D., F.R.S.	3rd February.
Lecture II.	Mechanical Physics	Rev. B. M. Cowie, B.D.	10th February.
Lecture IV.	Mining - -	W. W. Smyth, M.A., F.R.S.	24th February.

SYLLABUS.

Subject I.—Practical Plane and Solid Geometry.

Every one employed in any constructive art must acquire the power of representing on paper the forms and proportions of the work to be executed, whether of machinery, civil or of naval architecture; and others, not immediately interested in construction require, in surveying, navigation, &c. a knowledge of practical as well as theoretical geometry of a more than elementary order.

The representations alluded to, although made on a flat surface, must suggest to the eye the relations of form or volume, and also by means of conventional tinting, or shading the materials of which the structure consists; these representations, called "drawings," because the same pencils and paper are made use of as by the artist, are entirely based on the theorems of geometry practically applied.

Since it is essential to their utility that geometrical drawing should be accurate, the draughtsman must by practice and instruction be sufficiently acquainted with geometry to be able to apply its theorems with readiness and precision, and be sufficiently skilful in the use of his instruments and materials to ensure neatness as well as accuracy in execution: without these qualifications it is assumed that no one will present himself for examination in this subject.

First Stage or Elementary Course.

Plane Geometry.

1. To divide finite lines in any ratio expressed either—
   - *a.* By *numbers*, integral or fractional, as *m, n, p.*
   - *b.* Or by given lines, as AB, PQ, &c.
2. To find a mean proportional, a third or fourth proportional to two or three given lines.
3. To divide finite lines so that the *area* of the rectangle contained by the segments may be of a proposed magnitude, given either—
   - *a.* By numbers as above; or
   - *b.* By a given polygon.
4. To construct a rectangle equal in area to that of a given triangle.
5. To construct a triangle from any sufficient data, as—
   - *a.* Its species and *perimeter.*
   - *b.* Its species and *area.*
   - *c.* Similar to a given one, but on a given line, as a base or side, or of a given area.
6. To reduce a polygon of four or more sides to an equivalent triangle.
7. To draw circles to touch given lines or circles, either—
   - *a.* Of a proposed radius; or
   - *b.* To pass through one or two given points.

Solid Geometry.

A general knowledge of the principles of *Projection* on two or three planes supposed to be at right angles to each other is necessary before attempting any of the following constructions, these projections are called *Plans, Elevations, Profiles.*

1. To represent by a *plan* and *elevation* any simple solid, when its form and its position with respect to the horizontal and vertical planes of projection (as represented by the paper) is given by adequate conditions.

2. To deduce a second or third elevation or plan of such a solid from the plan and elevation previously determined.
3. To determine by its plan, elevation, or by its *traces*, an indefinite line or plane in any position with respect to the paper or horizontal plane.

The *points* in which any line intersects the planes of projection are called the *traces* of that line; and the *lines* in which any *plane*, or other surface, intersects the same planes are termed the *traces* of that surface; these terms *traces* are never used in any other sense.

4. To determine lines passing through a given point parallel, perpendicular, or inclined at any angle to a given line, neither point nor line being in the paper.
5. To determine a plane to contain a given point (not in the paper), either parallel or perpendicular to a given plane.
6. To determine by its plan and elevation any plane figure when its position with respect to the planes of projection is given, either—
   a. By the inclinations to the paper of its plane and of one side.
   b. By the inclinations of two of its lines.

The principle on which this construction is made is the basis of all practical solid geometry. It is that *any* two planes may be supposed to be brought to coincide by the revolving of either of them on their mutual intersection; the construction itself when made or implied has recently been termed *rebattment* (from the French). It is by this supposition that the paper represents both co-ordinate planes of projection.

SECOND STAGE OR ADVANCED COURSE.

Plane Geometry.

1. The division of finite lines, or those lines produced—
   a. Medially or in extreme and mean proportion;
   b. Harmonically, one segment being given.
2. To determine by construction *lines* which shall be equivalent to magnitudes given by algebraical expressions, such as—

   a. $\sqrt{m}$, $\sqrt{\frac{m}{n}}$, $\sqrt{\frac{1}{m}}$; (*m* and *n* being *numbers.*)

   b. $\overline{a^2 \pm b^2}$, $\sqrt{ab}$, $\frac{\sqrt{ab}}{c}$, $\frac{\sqrt{m}+n}{k}$, &c., &c.

3. The construction of triangles from adequate conditions of sides, angles, area, perimeter or trigonometrical functions, as sin A, cos B, tan C, &c.
4. The division of polygons into *m* areas by parallel lines, or by lines drawn through a given point.
5. To draw circles to touch given lines and circles and to pass through two given points.
6. The construction of those plane curves which are required in practical arts (ellipse, parabola, cycloid, &c., &c.)
7. The construction of "scales" to drawings, to different units of measure, English and foreign.

Solid Geometry.

1. The graphical representation of curved surfaces of revolution by their sections or otherwise.
2. The representation of such surfaces, either touching or intersecting each other, according to some given condition.

3. The determination of planes touching such surfaces, and containing given lines or points, or else cutting such surfaces under given conditions.
4. The *development* of conical and cylindrical surfaces, with that of lines on those surfaces.
5. The determination of the shadows of solid bodies bounded either by planes or curved surfaces by parallel or converging rays of light, the shadows being cast on planes.

N.B.—The questions for examination in this advanced course will also comprise all the first course as regards both plane and solid geometry, only under more complex conditions. Thus the candidate, for example will be required to determine the plan and elevation of solids of any kind from a plan and elevation of more easy delineation than that required; this construction may be termed by analogy the practical *transformation of co-ordinates.*

Examination for Honours.

Plane Geometry.

Candidates for honours will be required to make constructions relating to the contact of lines and circles with each other, and with other curves, requiring more knowledge of geometry, and the power of making deductions, than is expected of other candidates; but the questions on these and other subjects will be of a practical utility in geometrical drawing. They must possess some knowledge of analytical geometry so as to be able to construct lines or circles given by algebraical expressions referring to co-odinate geometry of two dimensions such as $\frac{x}{a}+\frac{y}{b}=1$; $x \sin \alpha+y \cos \alpha-p=0$; $(x-a)^2+(y-b)^2=r^2$, &c., &c.

Solid Geometry.

The candidate will be expected to be conversant with the principles of co-ordinate geometry of three dimensions so far as to determine by their projections on three rectangular planes, points, and lines, and by their *traces* planes, the position of which is given by their equations such as—

$$(x=\pm a,\ y=\pm b);\ (y=mx+n,\ \ z=kx+l);\ \frac{x}{a}\pm\frac{y}{b}\pm\frac{z}{c}=1;$$

$$x \cos \alpha \pm y \cos \beta \pm z \cos \gamma \pm p=0;$$

$$(x-a)^2\pm(y-b)^2\pm(z-x)^2=r^2, \text{ \&c., \&c.}$$

He will be expected to demonstrate some theorems of this subject on which constructions are based relating to the parallelism or perpendicularity of lines and planes, and the relation of the projections of areas to the originals.

He will have to construct lines and planes inclined to given planes at oblique angles, and lines and planes touching surfaces of the second order, as the ellipsoid, paraboloid, &c., &c.

He must, by the projections of their generators, define surfaces, the *law* of their generation being given, and determine tangent and normal planes to such surfaces.

When surfaces of any order are represented by the projections of sections made by parallel equidistant horizontal planes, they are said to be *contoured.* This mode of graphically defining surfaces is by far the most useful; in surveying it is employed to represent the natural

ground or the earth-works constructed in embanking, tunneling, fortification, &c. The lines of contours suggesting to the eye the nature of the surface as regards its inclination, slope, or its variations in horizontal direction.

The *contours* of geometrical surfaces are geometrical lines capable of accurate determination and construction, the candidate will be required occasionally to show surfaces plane or curved by their contours.

The mutual intersections of curved surfaces are *curves of double curvature*, which can only be represented by their projections; and normal and osculatory planes to such lines can only be drawn when the surfaces on which these lines lie can be graphically represented. Easy cases of these constructions are required by the carpenter, by the mason, and shipwright, in the construction of vaults, cupolas, oblique bridges, vessels, and on other occasions.

Many problems are solved by the principle of development, such as the solution of the spherical triangle, the construction of maps.

The candidate must be acquainted with the principles of *perspective* or radial projection, so as to be able to represent any building on those principles, but he must also understand the determination of the radial projection of simple solids deduced from their orthographic projection, and the construction of planes and lines analogous to the elementary constructions of orthographic projection.

The candidate cannot be expected to make complicated constructions in the time allowed for this examination, but the questions will be so selected and diversified that he can prove his knowledge of all the subjects of this syllabus by the easy constructions those questions may require, and such demonstrations or definitions he may be called on to make may be quickly given in brief expressions, either in words or algebraically.

The following books are recommended for study in Subject I. :—

For Theoretical Geometry.

Euclid's Elements of Geometry (School Edition), by R. Potts, 12mo., 4*s.* 6*d.* (London, Longman, 1868.)

Plane Geometry according to Euclid (Chambers' Series), by A. Bell, 12mo., 1*s.* 6*d.* (London, Chambers.)

Elements of Euclid (Weale's Series), by H. Law, 12mo., 2*s.* (London, Virtue, 5th ed., 1868.)

Manual of Euclid, by J. A. Galbraith and S. Haughton, 12mo., two parts, 2*s.* 6*d.* each. (London, Cassell, 1868.)

Éléments de Géométrie, par Legendre, *avec Notes* par Blanchet, 8vo., 4*s.* (Paris, Didot, 11th ed., 1867.)

For Analytical Geometry.

Treatise on Plane Co-ordinate Geometry as applied to the Straight Line and the Conic Sections, by I. Todhunter, 8vo., 7*s.* 6*d.* (London, Macmillan, 4th ed., 1867.)

A Treatise on Conic Sections, by G. Salmon, 8vo., 12*s.* (London, Longman, 4th ed., 1863.)

Analytical Geometry of Three Dimensions, by G. Salmon, 8vo., 12*s.* (Dublin, Hodges & Smith, 2nd ed., 1865.)

Treatise on the Analytical Geometry of Three Dimensions, by J. Hymers, 8vo., 10*s.* 6*d.* (Cambridge, Deighton, 3rd ed.)

Éléments de Géométrie, par S. F. Lacroix, 8vo., 4*s.* (Paris, 1863.)

Analyse appliquée à la Géométrie des trois Dimensions, par C. F. A. Leroy, 8vo., 6*s.* (Paris, 1854.)

For Practical Geometry.

Practical Geometry, by Thos. Tate (Gleig's series), 18mo., 1*s.* (London, Longman, 1868.)

Elements of Geometrical Drawing, by Thos. Bradley, in two parts, oblong folio, each 16*s.* (London, Chapman & Hall, 1862.)

Practical Geometry, Linear Perspective, and Projection, by Thos. Bradley (Library of Useful Knowledge), 8vo. (London, Baldwin.)

Elements of Descriptive Geometry, by J. Woolley, text 8vo., plates 4to., 20*s.* (London, Parker, 1850.)

Elementary Geometrical Drawing, by S. H. Winter, in two 8vo. parts, 3*s.* 6*d.* and 6*s.* 6*d.* (London, Longman, 1861.)

Elementary Treatise on Descriptive Geometry, by J. F. Heather, (Weale's series), 12mo., 2*s.* (London, Weale, 1851.)

First Lines in Geometrical Drawing, by J. F. H. De Rheims, 8vo., 9*s.* (London, Williams & Norgate, 1865.)

* *Traité de Géométrie Descriptive,* par J. Adhémar (with Atlas), 8vo. 20*s.* (Paris, 4th ed.)

Essais de Géométrie sur les Plans et les Surfaces Courbes, par S. F. Lacroix. (Paris, 7th ed.)

Traité de Géométrie Descriptive, par Lefébure de Fourcy, 2 vols., 8vo. (Paris, 1864.)

Traité de Géométrie Descriptive, par La Vallée (with Atlas), 4to., 15*s.* (Paris, 2nd ed., 1825.)

Traité de Stéréotomie, &c., par C. F. A. Leroy, *annotée* par E. Martelet, 4to. (with Atlas in folio). (Paris, 1866.)

Notes et Croquis de Géométrie Descriptive, par Bardin, folio, 10*s.* (Paris, 2nd ed., 1837.)

Subject II.—Machine Construction and Drawing.

First Stage or Elementary Course.

The candidate will have to draw from sketches and written conditions the elementary constituent parts of all mechanism, such as wheels, cams, links, cranks, couplings, shafting, excentrics, cushions, or pillow blocks, but he must show his knowledge of machinery by supplying those details and that finish of execution that are intentionally omitted in the sketch. Any indication in the candidate's work that he has simply copied the sketch, only altering the scale, without understanding the principle of the mechanism, will invalidate his examination.

The essential condition of *symmetry* which characterizes all the works of man, that of being counterpart on each side of a central line or axis of symmetry, indicates the proper mode of drawing such objects; this principle in drawing, which may be called "copying by co-ordinates," must be rigorously observed, not only in the general forms but even down to the smallest details; unless it is so the drawing must be worthless, because inaccurate.

Second Stage or Advanced Course.

The candidate will have to represent combinations of the above-named elementary parts in machinery, as engines, lathes, drilling, planing machines, tools, clock-work, &c. He will have unfinished sketches of such combinations set before him, and he will be expected occasionally to show the parts in that different position which would be produced by the motive power acting on mutually dependent parts.

* The most practical of all French works.

He will also occasionally be required to show, in skeleton outline, new combinations for effecting some changes of motion and velocity according to conditions.

He must also be able to represent parts of mechanism that admit of it in isometrical projection.

Examination for Honours.

The candidate will be required to make one or more drawings to scale of some machine intended to effect a prescribed operation, from a description, aided by sketches of those parts requiring especial explanation. These drawings he will be allowed to execute at his own home.

In addition he will have to answer in writing, and by sketches to scale illustrating his answers, questions on the general principles of mechanism, the modes on connecting the *power* with the *work*, the effects of friction in modifying the result, the different modes of changing the velocity of the motions produced, and generally, analogous questions intended to ascertain his knowledge of machinery, and the means of representing it.

Works containing illustrations of engines, tools and machines are too numerous and well-known to require enumeration, but for the principles of mechanism, the following are particularly recommended:—

The Elements of Mechanism, by T. M. Goodeve, 8vo., 6*s*. 6*d*.
(London, Longman, 2nd ed., 1865.)

Dynamics, Construction of Machinery, by G. F. Warr, 8vo., 9*s*. 6*d*.
(London, Baldwin, 1851.)

The Principles of Mechanism for the Use of Students, by R. Willis, 8vo., 15*s*. (London, Parker & Son, 1841.)

Subject III.—Building Construction.

First Stage or Elementary Course.

The candidate will have to draw from unfinished sketches, as stated for the preceding subject, parts of constructions, such as walls, floors, roofs, partitions, arches, &c. The same remarks and injunctions apply here as for Subject No. II. In building construction the knowledge of the candidate will be shown by the bond of his brickwork, the framing and scantling of his timber, and joinery of his doors and sashes, and by the characteristic peculiarity of cast or wrought-iron structures.

Second Stage or Advanced Course.

The candidate will, in addition to more elaborate drawings of the same elementary parts, have to draw parts of viaducts, bridges, embankments, docks, &c. &c., and will have to answer, in writing, questions on the material, brick, stone, slate, timber, &c. used in such works.

In addition he will occasionally be called on to design parts of structures according to given conditions of use and material, but as the time allowed for the examination does not admit of any complicated drawing, he can only be expected to show his knowledge and taste by his drawing as far as it goes.

Examination for Honours.

The candidate will have to make one or more drawings of a building for some special use from description and specification, these drawings he will be allowed to execute at his own home. He will also have to answer in writing, illustrated when directed by sketches to scale, questions on the following subjects:—

The different materials used in building, the mode of preparing them and their application in different parts.

The framing of timber in roofs, floors, partitions, stairs, &c.

The use of iron, cast or wrought; the construction of lattice girders in viaducts, bridges, &c.

The construction of brick, stone, or iron bridges, direct or oblique, suspension bridges, tunnels, drains, &c., &c.

Works containing examples of building construction are numerous. The following is recommended:—

Examples of Building Construction, by H. Laxton, in four parts, folio, each 2*l.* 10*s.* (London, 1856–62.)

Subject III (Alternative).—Naval Architecture.

First Stage or Elementary Course.

Candidates for the elementary course will be required to possess sufficient knowledge of practical ship-building, to apply the various materials used for that purpose to the greatest advantage. Also to be able to make sketches, to scale, of the component parts of a ship's hull.

Second Stage or Advanced Course.

Candidates for the more advanced course will, in addition to that directed for the elementary course, be required to make detail and working drawings, showing a knowledge of the methods of combining the several parts of a ship's hull. Also to possess a knowledge of laying off on the mould loft floor.

Examination for Honours.

The honours examination will embrace questions relating to the calculation of displacement, in addition to that prescribed for the preceding courses; and the candidates will be required to make a drawing at home, comprising sheer, half-breadth and body plans, from data which will be furnished.

Neatness and accuracy in drawing will be insisted on.

The following works will comprise all that the teachers will require as text books, viz.:—

Rudiments of Naval Architecture, by James Peake (Weale's Series), 12mo., 3*s.* (London, Weale, 1851.)

Shipbuilding in Iron and Steel, by E. J. Reed. (London, Murray, 1868.)

Directions for Laying-off Ships, by J Fincham, 8vo., 25*s.* (London, Whittaker, 1840.)

Outline of Shipbuilding, by J. Fincham, 8vo., 31*s.* 6*d.* (London, Whittaker, 1853.)

Shipbuilding, Theoretical and Practical, edited by W. J. M. Rankine, folio, 84*s.* (London, Mackenzie, 1866.)

Subject IV.—Elementary Mathematics.

The questions which will be set in the two grades or stages of the class examination will be confined to the following subjects, and the answers which will ensure full marks must be given in accordance with the instructions annexed to each division.

1. *Arithmetic generally.*—The performance of numerical calculations with accuracy and lucid arrangement and explanation of the reasons of processes of a simple kind may be demanded. This branch is mentioned not so much as a separate subject, but because wherever examples are given which involve *numbers*, the complete solution in figures should be given: that it may be ascertained by the examiner that the candidate can from formulæ in symbols deduce useful numerical results.

   Decimal fractions in all cases to be shown (not *vulgar fractions*).

2. *Geometry.*—The properties of lines, triangles, rectilinear figures, the circle, properties of similar figures, inscribed and circumscribed polygons.

   The examination questions in this subject will generally be set in the words of Simson's Euclid, but any logical proof of a proposed theorem, or accurate solution of a problem, will receive full credit if it be clearly evident that the candidate has apprehended the course of reasoning which preceded the proposition. Candidates should endeavour to draw good figures, and should as much as possible keep the demonstration on the same page with the figure.

3. *Algebra.*—Definitions. Simple rules. Greatest common measure and least common multiple. Indices. Involution and Evolution. Simple equations and problems producing them. Fractions. Quadratic equations and problems producing them. Ratio. Proportion. Variation. Permutations and combinations. Progressions, arithmetical, geometrical, harmonical; and the binomial theorem for a positive integral index.

4. *Plane Trigonometry.*—Definitions. Conversion of degrees and their subdivisions into grades, and their subdivisions, and *vice versâ.* Angular and circular measures of degrees and their relation. The goniometric functions of angles and the conversion of one into another. The arithmetical values of the goniometric functions of 90°, 45°, 60°, 30°, 180°, 120°, 150°, &c. The meaning of contrariety of signs in trigonometry. Tracing of the goniometric functions in magnitude and algebraic sign through the four quadrants and when an angle is indefinitely increased.

   Formulæ for multiplication and division of angles, viz: sine, cosine, tangent, &c., of $(A \pm B)$, $2A$, $3A$, $\frac{A}{2}$, and $\frac{A}{3}$. Also of A and B in terms of $\frac{A+B}{2}$ and $\frac{A-B}{2}$.

   Logarithms.—Definition. Multiplication, Division, Involution and Evolution by logs. The use of logarithmic tables. Tables of proportional parts for numbers and angles. Modulus. Construction of logarithmic tables, and of tables of logarithmic sines, cosines, &c.

   Triangles.—Formulæ for cosine of an angle of a triangle in terms of its sides. The relation between sines of angles and the opposite sides; sine, cosine, tangent, &c., of half an angle of a triangle in terms of sides, and of the sine of an angle. Area of a triangle. Solution of triangles. Diameters of circles inscribed in and circumscribed about a given triangle. Areas of regular polygons inscribed in and circumscribed about a given circle. Area of a circle. Description and use of vernier and theodolite and sextant. Heights and distances of inaccessible objects.

The extent of the examination is shown by the detailed particulars under each head.

First Stage, or Elementary Course.

In the first paper the questions will be restricted—

1. In geometry to the properties of lines, triangles, rectilinear figures, and the circle, (*i. e.* in the case of Euclid's elements not beyond the end of the third book).
2. In algebra, the subjects mentioned above up to and including simple equations and questions producing them, together with proportion and arithmetical and geometrical progressions.
3. *Trigonometry.*—The subjects mentioned before *logarithms.*
   Logarithms.—The use of logarithms and logarithmic tables only including the tables of proportional parts.
   Triangles.—The solution of right-angled triangles only, and such problems of heights and distances as depend only on the solution of right-angled triangles.

The lowest class of those who will be approved on this paper may be reached by students who know accurately the first book of Euclid, can solve simple equations, and can prove the formulæ for solution of right-angled triangles.

Second Stage, or Advanced Course.

In the second or advanced stage, the questions will go over the whole extent of the subject as set forth in the detailed syllabus given above.

Examination for Honours.

The range of subjects being the same, it will be proposed in this paper to place before the student questions which will be chiefly problems or theorems of the more difficult kind in each part. In algebra, the examples given will require more familiarity with the subject: in geometry, the questions will chiefly be deductions, or may require the aid of trigonometry as well as pure geometry for their complete answer: in trigonometry, besides questions which will exercise the student's ingenuity and test his familiarity with principles, the subject of angles greater than two right angles, and the relations between trigonometric ratios and all the angles which they indicate, will be included; trigonometric eliminations and transformations and the application of algebra to geometry must be familiar. (It is not meant by this that analytical geometry or the equations of the line and circle will be required, but chiefly the algebraic representation of geometrical ratios.)

The books in which elementary mathematics may be studied are too numerous to be mentioned, but as specimens of good and trustworthy treatises, which may be used with advantage by candidates who have little or no assistance, the following works by Mr. Todhunter may be recommended:—

Algebra for Beginners, 18mo., 2*s*. 6*d*.
(London, Macmillan, new ed., 1867.)

Algebra for the use of Colleges and Schools, 8vo., 7*s*. 6*d*.
(London, Macmillan, 4th ed., 1866.)

Trigonometry for Beginners, 18mo., 2*s*. 6*d*.
(London, Macmillan, 1866.)

Elements of Euclid, 18mo., 3*s*. 6*d*.
(London, Macmillan, new ed., 1864.)

Plane Trigonometry. 8vo. 5*s*. (London, Macmillan, 2nd ed., 1861.)

More advanced students may study with advantage:—
Wood's Elements of Algebra, by T. Lund, 8vo., 12*s.* 6*d.*
(London, Longman, new ed., 1861.)
which contains an abundant supply of examples in Algebra.

Also,—
Arithmetic and Algebra, by Barnard Smith, 8vo., 10*s.* 6*d.*
(London, Macmillan, 7th ed., 1860.)
may be found useful.

Subject V.—Higher Mathematics.

First Stage or Elementary Course.

1. *Algebra.*—Theory of indices (fractional and negative). Binomial theorem with fractional and negative indices. Interest, equation of payments, annuities. Multinomial theorem (integral exponent). Exponential theorem. Indeterminate equations and problems of the first degree. Indeterminate coefficients. Resolution of easy rational fractions into partial fractions. Scales of notations. To express numbers in different scales. Logarithmic series.
2. *Trigonometry.*—Demoivre's theorem for a positive integral index. To express the sine, cosine, and tangent of the sum of any number of angles in terms of the sines, cosines, and tangents of the simple angles. To express the sine, cosine, and tangent of a multiple angle in terms of the powers of the sine, cosine, and tangent of the angle. To express the powers of sine, cosine, and tangent of an angle in terms of the sines, cosines, &c., of the multiple angle. Expressions for sine, cosine, and tangent of an angle in terms of the angle.
3. *Spherical Trigonometry.*—Definitions and fundamental properties with regard to limits of values of sides and angles. To express the arc of a small circle in terms of the corresponding arc of a great circle. The polar or supplemental triangle and its properties. The area of a spherical triangle in terms of the angles (spherical excess). To prove that the sines of the angles are proportional to the sines of the opposite sides. To express the cosine of an angle in terms of the cosines and sines of the sides, and the cosine of a side in terms of cosines and sines of the angles. To express the relation between two sides and two angles, one of which is included by the sides (*e.g.*, $\text{Cot}\ a\ \text{Sin}\ b = \text{Cos}\ b\ \text{Cos}\ C + \text{Sin}\ C\ \text{Cot}\ A$). Solution of right-angled, quadrantal, and isosceles triangles.
4. *Co-ordinate Geometry and Conic Sections.*—Co-ordinates of a point. To express the area of a triangle in terms of the co-ordinates of the angular points. Locus of an equation. Equation to a curve.

   Equation to a straight line in various forms referred to rectangular, oblique, and polar co-ordinates. Equation to a straight line through one or two points, or parallel to a given straight line. Co-ordinates of points of intersection of two or more straight lines.

   To find the angle between two given straight lines, and the equation to a straight line perpendicular to a given straight line, or making a given angle with it. To find the length of the perpendicular let fall from a given point on a straight line. (Rectangular axes.)

   Transformation of co-ordinates by changing the origin, by changing the direction of the axes, both rectangular and oblique, by changing rectangular to polar co-ordinates, and *vice versâ.*

   The Circle.—Equations to the circle and to the tangent and normal of a circle at any point.

Parabola.—Definition, and equation referred to rectangular axes. To find the equation to the tangent and normal. To show that SP = ST = SG. To find the length of the perpendicular from the focus on the tangent.

Ellipse.—Definition and equations (rectangular axes). Directrices and foci. To express the focal distance in terms of the abscissa. The sum of the focal distances is equal to the axis major. The excentric angle. To express the co-ordinates of a point in terms of the excentric angle.

The equations to the tangent and normal. To show that $CT = \frac{CA^2}{CM}$, $CG = e^2CM$.

The normal bisects the angle between the focal distances; the length of the perpendicular from the focus on the tangent.

Hyperbola.—Corresponding propositions to those for the ellipse. The equilateral or rectangular hyperbola.

5. *Differential Calculus.*—Definitions. Limit. Differential coefficient. Differential coefficients of sum, product, or quotient of functions.

To find the differential coefficients of x^n, a^x, $\log_a x$, $\sin x$, $\cos x$, $\tan x$, $\sec x$, $\cot x$, $\sec x$.

To find the differential coefficients of the inverse trigonometrical functions, *e.g.*, $\sin^{-1}x$, $\cos^{-1}x$, $\tan^{-1}x$, &c., and to find $\frac{du}{dx}$ when $u=f(y)$ and $y=\phi(x)$, with examples.

Expansion in series by Taylor's and Maclaurin's theorems with easy examples.

To find the limiting values of functions which assume an indeterminate form (easy vanishing fractions).

To determine the maxima and minima values of functions of one independent variable, with examples.

Tangents and normals to plane curves. Subtangent and subnormal.

6. *Integral Calculus.*—Meaning of integration. Elementary integrals. Integration of more simple rational fractions.

Second Stage, or Advanced Course.

In addition to the propositions in the elementary course given above, the candidate will be required to know the more advanced parts of the same subjects.

1. *Algebra.*—Multinomial theorem for negative and fractional exponents. Reversion of series. Continued fractions. Reduction of a quadratic surd to a continued fraction. Summation of series. Theory of quadratic surds. Theory of numbers. Prime numbers. Forms of numbers. Fermat's theorem.

2. *Trigonometry.*—Demoivre's theorem with negative or fractional exponents. The exponential expressions for the sine, cosine, and tangent of an angle. Series by help of these expressions.

Solution of quadratic and cubic equations by trigonometry. Summation of series of sines, cosines of angles in arithmetic progression, and of other series dependent on these.

3. *Spherical Trigonometry.*—Napier's analogies and Gausse's formulæ, viz.:—

$$\text{Cos}\ \tfrac{1}{2}(A+B)\ \text{Cos}\ \tfrac{1}{2}c = \text{Cos}\ \tfrac{1}{2}(a+b)\ \text{Sin}\ \tfrac{1}{2}\ C.$$
$$\text{Cos}\ \tfrac{1}{2}(A+B)\ \text{Sin}\ \tfrac{1}{2}c = \text{Sin}\ \tfrac{1}{2}(a+b)\ \text{Sin}\ \tfrac{1}{2}\ C.$$
$$\text{Sin}\ \tfrac{1}{2}(A+B)\ \text{Cos}\ \tfrac{1}{2}c = \text{Cos}\ \tfrac{1}{2}(a-b)\ \text{Cos}\ \tfrac{1}{2}\ C.$$
$$\text{Sin}\ \tfrac{1}{2}(A+B)\ \text{Sin}\ \tfrac{1}{2}c = \text{Sin}\ \tfrac{1}{2}(a-b)\ \text{Cos}\ \tfrac{1}{2}\ C.$$

Solution of oblique-angled triangles and ambiguous cases. Spherical excess in terms of the sides of a triangle, &c. Radii of circles inscribed in and circumscribed about a spherical triangle.

4. *Co-ordinate Geometry.*—Angles between straight lines, perpendiculars on them, and length of perpendiculars referred to oblique axes. Polar equation to a straight line which passes through two given points.

Circle.—Chord of contact of tangents to a circle through an external point. Locus of intersection of tangents drawn at extremities of chords which pass through a fixed point. Circle referred to oblique and polar co-ordinates.

Parabola.—Chord of contact and problems depending on it. Locus of intersection of tangent with the perpendicular on it from the focus.

Diameters; their properties. Equation to the parabola referred to diameter and tangent at its extremity as axes. Tangents at the extremities of any chord of a parabola meet in the diameter which bisects that chord.

The parabola referred to polar co-ordinates. Properties connected with tangents drawn at the extremities of a focal chord. If through any points within or without a parabola, two lines be drawn parallel to two given straight lines to meet the curve, the rectangles of the segments will be to one another in an invariable ratio.

Ellipse.—Chords of contact. Conjugate diameters and their properties. Equation to ellipse referred to conjugate diameters as axes. Properties connected with tangents drawn at the extremities of a focal chord.

The ellipse referred to polar co-ordinates. If through any point within or without an ellipse two lines be drawn parallel to two given straight lines to meet the curve, the rectangles of the segments will be to one another in an invariable ratio.

Hyperbola.—Corresponding propositions to those for the ellipse. Conjugate hyperbola. Asymptotes. Equation to hyperbola referred to asymptotes as axes, to tangent, &c.

General Equation of Second Degree.—To show when it represents ellipse, hyperbola, parabola, circle, or two straight lines. The equation to a conic section referred to a pair of tangents as axes.

Sections of a right cone made by a plane perpendicular to a plane containing its axis.

5. *Differential Calculus.*

Successive differentiations of simple functions, and of the product of two functions (Leibnitz's theorem), with examples. Application of Taylor's and Maclaurin's theorems to more complicated expansions. Differentiation of functions of two independent variables. If $y = z + x\phi(y)$ to expand $f(y)$ according to ascending powers of x (Lagrange's theorem).

Vanishing fractions (more complicated). Maxima and minima values of functions of two independent variables with examples. Differentiation of implicit functions. Elimination of constants or functions by differentiation.

Curves, asymptotes, tangents, and normals referred to polar co-ordinates. Polar subtangent; asymptotes referred to polar co-ordinates.

To determine whether a curve is concave or convex with respect to a given line: to find points of inflexion. Tracing of curves.

To find the differential coefficients of an arc, area, volume, and surface of revolution (rectangular and polar axes). Contact, circles of curvature and evolute.

6. *Integral Calculus.*

Formulæ of reduction. Integration between limits. Double integration.

Application to length and areas of curves and to volumes and surfaces of solids of revolution.

Examination for Honours.

In addition to the above:—

1. *Algebra.*—Convergency and divergency of series and recurring series. Indeterminate equations of a higher degree than the first.

   Properties of numbers. Wilson's theorem. To find the number of positive integers less than a given number and prime to it; number of divisors of a given number; number of ways into which a number can be resolved into its prime factors and polygonal numbers.
2. *Trigonometry.*—Construction of tables. Formulæ of verification. Proportional parts in logarithmic functions of angles.
3. *Spherical Trigonometry.*—Regular polyhedron, parallelopiped, and tetrahedron, with problems.
4. *Co-ordinate Geometry and Conic Sections.*—Problems in the straight line and circle. Radical axis, pole and polar. Supplemental chords to ellipse and hyperbola. Miscellaneous propositions. Similar curves. Anharmonic and harmonic pencils.
5. *Differential Calculus.*—Limits and failure of Taylor's theorem; Laplace's theorem.

   Second differentiation of implicit functions; change of the independent variable (1) when there is one independent variable, (2) when there are two independent variables.

   Maxima and minima values of functions of several independent variables.

   Curves. Singular points. Multiple points. Cusps, &c. Envelopes.
6. *Integral Calculus.*—Elliptic functions.

In preparing for examination in the courses described in the above Syllabus the student may use any standard works, and the following by Mr. Todhunter will be found especially useful:—

Algebra for Colleges and Schools, 8vo., 7*s*. 6*d*. (London, Macmillan, 4th ed., 1866.)
Conic Sections, 8vo., 7*s*. 6*d*. (London, Macmillan, 3rd ed., 1862.)
Plane Trigonometry, 8vo., 5*s*. (London, Macmillan, 2nd ed., 1861.)
Spherical Trigonometry, 8vo., 4*s*. 6*d*. (London, Macmillan, 2nd ed., 1863.)
Treatise on the Differential Calculus, 8vo., 10*s*. 6*d*. (London, Macmillan, 4th ed., 1865.)
On the Integral Calculus and its Application, 8vo., 10*s*. 6*d*. (London, Macmillan, 2nd ed., 1857.)

Subject VI.—Theoretical Mechanics.

(1.)—First or Elementary Course.

The student who takes up this course is expected to give clear and full statements of the principles of the science, and to show that he understands them by answering easy questions on their applications. These questions will not demand for their solution a knowledge of mathematics beyond the elements of algebra, mensuration, and geo-

metrical constructions by scales and compasses. The formal proof of theorems will not be required except in the cases specified below:—

A.—*Statics.*

(1.) The composition and resolution of forces and the conditions of their equilibrium, viz., the parallelogram, triangle, and polygon of forces. Parallel forces. Equivalence of two couples. Composition of a couple and a force. The principle of moments.

(2.) Physical properties of solids, hardness, elasticity, tenacity.

(3.) Centre of gravity. Its position in the case of a straight line, parallelogram, circle, triangle, sphere, pyramid, and cone, of uniform density; and in the case of several heavy points.

(4.) Reaction of a fixed point or fulcrum. Equilibrium of a body capable of turning round a fixed point; levers; the balance, and its sensibility; the steel-yard.

(5.) Transmission of force through a rigid body and through a perfectly flexible thread. The single pulley. Simpler combinations of pulleys.

(6.) Reaction of smooth and rough surfaces; the limiting angle of resistance, or angle of repose; the coefficient of friction; the laws of friction.

(7.) Conditions of equilibrium of a body resting under the action of forces on a plane whether smooth or rough, horizontal or inclined; equilibrium of a wall sustaining an oblique thrust; buttresses.

(8.) Stable and unstable equilibrium.

(9.) Unit of work, and horse power; simple questions as to the working power of agents; the modulus of a machine.

B.—*Dynamics.*

(1.) Measure of time, distance and velocity uniform or variable. The accelerative effect of a constant force, and particularly that of gravity. Relations between space, velocity and time in the case of the rectilinear motion of bodies whose velocities are uniformly accelerated. Composition of velocities.

(2.) Definitions of mass, momentum, moving force and of vis viva, energy or accumulated work. The laws of motion. The absolute unit of force.

(3.) Rectilinear motion of a body under the action of given forces; Atwood's machine; motion on an inclined plane, and in a circle; centrifugal force; time of small oscillation of a simple pendulum. Centre of oscillation of an oscillating body.

(4.) Impulsive forces; velocity after direct impact of spheres; transformation (or loss) of accumulated work in collision.

C.—*Hydrostatics and Pneumatics.*

(1.) Law of transmission of pressure through a fluid; pressure of a fluid against a plane area; the centre of pressure; equilibrium of a reservoir wall.

(2.) Pressure of a fluid on a body wholly or partly immersed. Specific gravity of a solid or liquid; and the simpler cases of its determination. Conditions of equilibrium of a floating body. The metacentre. Conditions of stability of a floating body.

(3.) Experiments which show that air is an elastic fluid; the Magdeburg hemispheres; the cistern barometer; Boyle's experiment. Relation between pressure, temperature, and volume of a gas.

(4.) **Well known machines and the principles of their construction**; the hydraulic press; the specific gravity balance; the hydrometer; Nicholson's hydrometer; the specific gravity bottle; the ordinary suction and forcing pumps; the syphon; the air pump.

The student should be able, if required, to prove :—

(*a.*) The rule for determining the *magnitude* of the resultant of two intersecting forces, assuming the rule for its *direction.*

(*b.*) The rule for determining the resultant of two parallel forces.

(*c.*) That the sum of the moments of two intersecting forces with reference to any point in their plane, equals the moment of their resultant with respect to the same point.

(*d.*) That two couples acting in the same plane will be in equilibrium if their moments are equal and of contrary signs.

(*e.*) The rule for finding the centre of gravity of a triangle.

(*f.*) The formulæ for uniformly acclerated rectilinear motion, viz. :—

$$v = V + ft. \qquad s = Vt + \tfrac{1}{2}ft^2. \qquad v^2 = V^2 + 2fs.$$

(*g.*) The formula for the *vis viva* of, or *work accumulated* in a moving body, viz., $\frac{1}{2}mv^2$ or $\frac{wv^2}{2g}$.

(*h.*) That the pressure of a fluid on a body wholly or partly immersed equals the weight of the fluid displaced, and acts vertically upward through the centre of gravity of the immersed part of the body supposed of uniform density.

(2.)—The Second or Advanced Course.

The student who takes up the second or advanced course is expected to be able to prove the fundamental theorems of mechanics, so far as the subject is included in the elementary course, and to work somewhat harder examples; thus :—In the elementary examination he might be asked to explain what is meant by "centrifugal force," and to work an easy example on the formula $F = \frac{mv^2}{r}$; in the advanced examination he might be asked to prove this formula as well as to work a somewhat harder example. He is also expected to pursue the subject into some of its leading developments.

(1.) Proof and applications of the equations of equilibrium of forces acting in one plane.

(2.) Conditions of equilibrium of simple machines when the friction of the parts is taken into account. Inclined plane, wedge, screw, pulleys, bodies capable of turning round an axle of finite radius.

(3.) The principle of virtual velocities and its application to machines in a state of uniform motion. Dynamometers.

(4.) Motion on rough inclined and horizontal planes. Motion of projectiles.

(5.) Moment of inertia. Effective forces. D'Alembert's principle. Resultant of effective forces and work accumulated in the case of a body turning round a fixed line. The fly wheel. The compound pendulum.

(6.) Oblique impact. Centre of percussion. The ballistic pendulum.

(7.) Calculation of heights by barometer. The aneroid barometer.

(8.) Motion of fluids through orifices, pipes, and open channels.

(9.) Capillary attraction.

The following books are recommended for study; but it will, of course, be understood that all are not needed by any one student.

Whewell's *Elementary Treatise on Mechanics.*
Todhunter's *Mechanics for Beginners.*
Twisden's *Elementary Introduction to Practical Mechanics.*
Galbraith and Haughton's *Hydrostatics.*
Besant's *Elementary Hydrostatics.*
Goodwin's *Elementary Course of Mathematics.*
Brooke's *Natural Philosophy.*
Ganot's *Elements of Physics by Atkinson.*

(3.)—Course for Honours.

The details of this course need not be specified, but it must be understood that the student should be prepared to answer questions on every branch of the subject as usually taught in the higher classes in colleges. In addition to the careful study of the usual text-books, such as Todhunter's *Analytical Statics*, Routh's or Griffin's *Rigid Dynamics*, Besant's or Miller's *Hydrostatics*, the student will find it very useful to study some work in which the subject is treated from a somewhat less exclusively mathematical point of view, such as the first 19 chapters of Jamin's *Cours de Physique*, Morin's *Notions fondamentales de Mécanique*, the first division of Thomson and Tait's *Natural Philosophy*, &c. The applications of abstract mechanics to questions of construction, &c. can be studied in Moseley's *Mechanical Principles of Engineering and Architecture*, and in Rankine's *Applied Mechanics.* It must be borne in mind that the study of the higher branches of mechanics can only be attempted with profit when it is preceded by a thorough knowledge of the elements; of so much, for instance, as is comprised in the first and second courses.

Subject VII.—Mechanics as an Art, or Applied Mechanics.

The subject of applied mechanics, considered as embracing generally the art of fashioning materials into various definite forms, of arranging these definite forms under such combinations that on the application of force a certain and invariable result will be obtained, including also the adaptation of forms and materials so that they afford the maximum resistance with the minimum of quantity.

This syllabus is arranged for three classes of candidates; the first is elementary in its character, and may be considered as a stepping-stone to the second or more advanced class; it is intended for the guidance of the first or elementary class of candidates, who will be expected to have a fair knowledge of most of the branches enumerated, and be able to give a precise and satisfactory answer on any of them, or to make clear, well-drawn hand sketches where such may be necessary for explanation.

The second part is intended for those in the more advanced class, who will be expected to have a thorough knowledge of all the subjects referred to in the syllabus for the elementary class, and, in addition, to have a fair understanding of the application of the principles in actual practice.

The third part is intended for candidates coming forward for "Honours examination," who will be expected to have a complete knowledge of the questions referred to in the two former parts of the syllabus, and, in addition, to have some acquaintance with the higher theoretical principles that are required for the close investigation of the foregoing or more practical part of the subject.

As the chief object of these examinations is to foster the education of young men for the practical duties of life in connexion with the engineering and manufacturing industries of the kingdom, it is intended that the examination in applied mechanics shall be in accordance therewith so far as may be practicable.

First Stage or Elementary Class.

Candidates of the elementary class will require to know the more prominent properties of materials used in the mechanical arts; the different natures of wood that are in common use; the leading characteristics of cast iron, wrought iron, and steel; copper, tin, and zinc; brass, gun metal, muntz metal, and other similar compounds used in machinery; leather, gutta-percha, and vulcanized india-rubber, as employed for mill bands or pump purposes.

The general principles on which various materials are made into form, by casting, forging, compressing, drawing, cutting, &c.; the purposes for which different materials are commonly employed, the reasons which determine their selection; the modes of uniting and combining the several parts of structures by screw bolts, rivets, keys, cotters, wedges, soldering, &c.

The general principles of mechanical work, units of work as distinguished from other units, unit of a horse power, the calculation of mechanical work, work of living agents, wind, water, steam, neglecting friction or other conditions.

The principle and construction of simple machines by the combination of several parts, levers, pulleys, wheel and axle, inclined planes, the wedge, screws. Likewise the more complex machines that are in common and extensive use, cranes that are worked by hand, the working headstock of a common turning lathe, cornmill, the time movement of an ordinary clock, &c.

The more common methods of transmitting motion by simple elementary parts or apparatus in extensive use; toothed wheels, considered as spur, bevil, mitre, worm, mangle, and eccentric; friction wheels, revolving shafts, couplings, bearings, drums, mill bands, fast and loose pulleys, conical pulleys for altering the rate of motion, clutches (forked and frictional); eccentric motion, camb motion, crank motion, reversing motion, intermittent motions; the pendulum, nature of a governor, cylinder and piston, slide valve, stuffing box, gland, fly wheel, safety valve, other similar details.

Expenditure of work through the agency of machines, effect of reducing or increasing velocity, loss arising from friction. Calculating the power of simple machines, cranes, pulleys, screws, their relative conditions in regard to friction, applicability for different purposes.

General properties of fluid pressure, water pressure, in tanks, on flood gates, weight of water, water power, power required to raise water, the principle of water forcing pumps, the Bramah press, hydraulic pressure, accumulator, pressure gauge, air pressure, weight of air, elasticity of air, air pump, barometer, aneroid, vacuum, vacuum gauge, syphon, diving bell, action of the common household pump, condensation of air, air gun, the balloon principle; effect of air pressure as regards sensible temperature, contrary effect when liberated; Smith's bellows principle, action of a blowing fan, principle on which chimneys produce a current of air, the blast pipe of locomotives, quantity of air required to produce the perfect combustion of fuel.

Three conditions of ice, water, and steam, sensible and latent heat, the several properties of steam taken advantage of in steam engines, action of steam in cylinder of steam engine, expansion of bodies by heat, thermometer, heat conducting power of bodies, the advantage of covering

steam pipes and cylinders with felt and other substances, principle of heating buildings by steam, water heating apparatus, difference between the evaporation of salt and fresh water.

Manufacturing as compared with making, principle of production by taking the pattern or figure from a copy; printing, coining, turning, planing, smiths' swages, founders' patterns; conditions of a straight edge, of a true surface; the true spindle of a lathe, principles of an instrument for cutting, penetration, stength. The action of a punch, file, saw, grinding stone. The effect produced by plunging red hot steel into cold water, nature of tempering steel.

Strength of cast iron, wrought iron, and steel in regard to tenacity and compressibilty. Strength of a simple wooden beam under different conditions of support, supported at the ends and loaded in the middle, uniformly loaded. Nature of a neutral axis in beams, strength of beam as affected by length, depth, and thickness. Advantage making cast-iron pillars hollow. Relative strength of chains to diameter of iron out of which they are made.

Second Stage or Advanced Class.

Candidates of the advanced class require a general knowledge of the different kinds of timber used in the arts, including strength and special properties, the several metals employed in engineering, their nature, preparation, and special properties, including tenacity, compressibility, hardness, brittleness, density, malleability, ductilitiy, elasticity, weight, specific weight.

General principles of the art of founding, construction of patterns, essential conditions of a mould for the reception of liquid metal, &c. Chilled castings, malleable castings. Principles of smithing or forging, nature of welding, production of form by welding, upsetting, drawing down, punching, bending. Steel management, temper for different purposes, effect of cooling in oil, case hardening. Principle of rolling iron, wire drawing, bolt and rivet making. Shearing machines, steam hammers, drop hammers, principle of the bolt and nut. Rivetting by hand, by machinery. Nature of soldering, the essential principles involved.

Machines considered as agents for changing power from the unsuitable to the required condition, not creating power. Nature of friction, reduction of friction by lubricants, coefficients of friction of different materials and surfaces, laws of friction, friction as affected by the mode of transmitting power through machines, a given quantity of power expended under any conditions of velocity.

Lever principle applied in the arts, beams of steam engines, beams variously arranged as regards fulcrum. Cranes, crabs, or other machines for lifting where power is accumulated by toothed wheel gearing. The friction of cranes, arrangements to avoid friction, friction of block and tackle, ropes, chains.

Inclined plane in the arts, friction of as key for fixing parts of machinery, friction a virtue. Power required to draw materials up inclined planes. The screw as a fixing agent, as an instrument for compressing, adjusting, dividing, manipulating.

Regularity of motion necessary, power irregular, work done irregular. Use of fly wheel, its power as depending on weight and velocity, efficiency on position; the fly wheel as an agent for storing power, rolling mill, punching machine; fly wheel not increasing power, steam hammers, springs, considered as accumulators of power, means for setting machinery in motion gradually. Steam, water, fast and loose pulley, friction clutches, efficiency as depending on an accumulation of small efforts, lowering goods with friction breaks on cranes, &c.

Machinery regular in regard to time, theory of pendulum, governors, peculiar construction of water-wheel governors, comparison of governors with pendulum.

Machinery considered in relation to its three essential parts; of receiving power, the prime mover, so called, the intermediate mechanism for conveying and modifying, the part which performs the required operation. The term "work" as expressing applied power, pressure, distance. Mode of calculating the power of different kinds of machinery. Use of dynamometers, indicators, &c.

Machinery construction, strength with lightness, correct fitting of moving parts, principles that govern the formation of teeth of wheels. Advantage of wood and metal working together, velocity as depending on relative diameters, advantages derived from high velocities, construction of modern shafting and gearing generally, all details. Best materials for bearings, both hard and soft, proportion of length to diameter, anti-frictional arrangements, broad surface advantages, &c.

Conveying work or power, by shafting, endless bands, through a tube in the condition of compressed air, water, steam, convenience determining selection, respective advantages of the several methods. The leather band as an agent, its coefficient of friction, adhesion, adaptability for changing velocity, efficiency as depending on velocity, various adaptations to convey power in different directions.

The advanced candidate should have precise knowledge of the different elementary mechanical contrivances for modifying motion: from fast to slow by the worm wheel, ratchets, double and single and frictional; for changing from rotary into rectilinear or the reverse, rack and pinion; crank motion as in steam engines, the opposite, as in slotting machines, by an endless groove on cylinder, by screw with reversing motion, mangle wheel principle, three bevil wheel arrangement, open and crossed bands, with two fast and two loose pulleys; contrivances for giving variable motion, such as the leather wheel on disc surface, the various forms of camb by which any motion may be obtained, &c.

Machinery construction considered with reference to form, proportion of parts, strength of parts as determined by necessity; cast iron, uniform cooling; wrought iron as modified by difficulty of fashioning into intricate form; bronze by cost, strength of revolving parts, inversely as motion, the lever principle, advantage of fixing parts at both ends applied to pillars, risk of fracture reduced, advantages derived from hollow framing, stiffening by ribs, comparative cost of both systems; form of parts as determined by the tenacity and compressibility of the materials, applied to beams, in machinery varied by other conditions causing inconsistencies of proportion; great advantage of rigid framing.

Strength of hollow cylinders not in proportion to mass, cylinder of hydraulic press, gun, &c., each layer of lamina under tension affords greatest strength, the practical difficulties; system of building up cylinders by successive hoops, put on by pressure or by shrinking, each layer under different tension.

The leading fundamental principles of pneumatics, practical applications, apparatus for producing a current of air, blowing engines, blowing apparatus generally, the fan principle, blowing, exhausting, applications, mechanical ventilation of mines and buildings, as used in cotton mills, in grinding processes.

Post office atmospheric tube, flour mills, mines, atmospheric elasticity; applications, atmospheric railways, engines working by compressed air, air vessels in pumping apparatus, cartridge seamless bag, envelope machine, button making, coal hewing, rock boring, dessicating timber.

The laws of hydrostatics and hydraulics, applications in the arts; raising water, ancient methods, modern steam pumping machinery,

pumps for lifting, forcing, plunging, bucket, horizontal, vertical, centrifugal, screw, scoop, wheel, &c.; water supply to towns, sewerage pumping machinery, syphon on large scale, Middle Level drainage, Mongolfier water ram, difference of friction with large or small pipes, flow of water through pipes, friction of mains, flow as affected by rust, high pressure water machinery, provision for non-elasticity, working from high reservoir, water-pressure engines, character of pumps, boiler, proving, application to hydraulic press, cranes, lifts, dock gates, capstan, bridges, rocket manufacture, water engines, &c.

Water as a motive power: water wheels, water engineering, making the most of fall, construction of dam, sluices, canal, situation for factory, Fairbairn's water wheels, mode of transmitting the power, reduction of friction, modes of ascertaining the quantity of water available; water power, nominal, actual; water acting by impulse, by weight, conditions determining greatest effect, manipulation of sluice by governor, water wheels coupled to steam engines, necessary provision; treatment of tidal water.

Gravitation water-pressure engines; turbines, various systems of construction, leading conditions to give best result, inherent defects, for high falls, for low falls, comparison with water wheels, useful effect, first cost, convenience and expense for repair, working in tail water, advantage from high velocity, equilibrium.

Engines deriving their power from heat, steam, hot air, gas; the source of heat, the equivalent of work in heat, loss of heat by present arrangements, the heat contained in fuel, steam boilers, stationary, marine, locomotive, materials for construction, strength of boilers for internal pressure, external pressure of elliptical or flat surfaces, boiler feeding, pumps, injectors, prevention of incrustation, explosion; general economy and management; steam engines, stationary, marine, locomotive, condensing, non-condensing, working expansively; leading conditions that determine waste, economy; the principle of valves, slide, equilibrium, &c.; steam hammer construction.

Machine tools for wood: the principle of copying as developed in sawing, planing, morticing, tenoning, drilling, shaping, carving, moulding gunstocks, &c. Machine tools for metal, the sliding rest principles combined with being self-acting, and shape or form derived by transfer from copy contained in apparatus; the dead centre principle, modern lathes, machines for planing, slotting, drifting, shaping, screwing, wheel cutting, rifling, drilling; advantage derived from introduction of true surface, correct measurement of parts, measuring machine, principles which determine the proper speed for cutting wood and metal, machines that act more by force than by cutting, shearing, punching; the principle of circular shears, &c., screwing apparatus various, advantage derived from uniform system of screws.

General machinery: cranes, hand, steam, travelling, portable, derrick, sheer legs. Paper manufacture, printing, coining. Textile manufactures, carding, spinning, weaving, sewing. Measuring. Turntables, weighing machines. Agricultural machinery, engines, steam plough, reaping, thrashing, modern grinding mills, traction engines.

Adaptation of form and material for maximum resistance, beams, cast iron, wrought iron; tubular girders, construction of roofs, timber bridges, suspension bridges, iron pillars; construction of tanks, strength of cast-iron pipes, hydraulic press cylinders, relation of ultimate strength of materials to limit of elasticity and safe working load.

Examination for Honours.

The foregoing syllabus will sufficiently indicate the nature of subjects that will form the basis for the "Examination in Honours in Applied

"Mechanics," it will be expected however, that the candidate in addition to being able to give an intelligent answer to the various questions, and to make hand sketches of such parts as may be required, shall be thoroughly grounded in the laws of nature, so far as they relate to the philosophical and mathematical principles on which the various branches of applied mechanics are founded, and the candidate should not only be familiar with the formulæ, but should be able to refer back to the data from which they are derived.

Books recommended:—Willis's *Mechanism*. Baker's *Elements of Mechanism*. *The books in Weale's series which treat on the subjects specified*. Twisden's *Practical Mechanics*. Goodeve's *Elements of Mechanism*. *Record of the International Exhibition*, 1862. Pambour's *Theory of the Steam Engine*. Pambour's *Locomotive Engine*. Clark's *Locomotive Engine*. Bourne on *Steam Engine*. Bree's *Railway Practice*. Camus on *Teeth of Wheels*. Barlow's *Strength of Materials*. Tregold's *Carpentry*. Kirkaldy's *Experiments on Wrought Iron and Steel*. *Report of Commissioners on Application of Iron to Railway Structures*. Fairbairn's *Useful Information for Engineers*. Holtzapffel's *Turning and Mechanical Manipulation*. *Engineers' and Machinists' Assistant*. 2 vols. *Engineers' and Machinists' Drawing Book*. *Useful Metals and their Alloys*. *The Founder's Guide*. Ede on *Management of Steel*.

Subject VIII.—Acoustics, Light and Heat.

I.—First Stage or Elementary Course.

Questions will be confined to the following topics:—

Acoustics.

The pupil ought to have a perfectly clear notion of the manner in which a *wave* is propagated.

He ought to know what is meant by the terms density and elasticity as applied to air and other bodies, and how heat and cold affect the density and elasticity of air.

He ought to be able to describe simple experiments to prove that air possesses both weight and elasticity. He ought to understand the law of Marriotte, the construction and use of the air pump, and what occurs when a sounding body is placed in a space from which the air has been withdrawn.

He ought to be taught to see the play of elasticity in the propagation of a sonorous wave through air, and to have a clear mental image of the condensation and rarefaction which make up such a wave. He must, of course, be able to distinguish between the motion of a wave and the motion of the particles which at any moment form the wave.

He ought to know how the velocity of a wave is affected by a change of density, by a change of elasticity, or by a change of both.

He ought to know the velocity of sound in air of the freezing temperature, and also the amount of augmentation of velocity for every degree of the thermometer. The temperature of the air being given, he ought to be able to calculate the velocity of sound through it, and the velocity of sound being given he ought to be able to calculate the temperature of the air.

No doubt or confusion must rest within his mind regarding the meaning of the terms *velocity*, *intensity*, and *amplitude*. He ought also to know the relation of the two last to each other.

He ought to know the laws of the reflection of sound by tubes and mirrors, and to be able to apply his knowledge to the explanation of echoes.

The law of inverse squares as applied to sound, ought also to be explained to the pupil.

He ought to be able to figure mentally the propagation of a sound-wave through solids and liquids as clearly as through air; to know the velocity of sound through water, and to be able to infer from this the relation of the density of the liquid to its elasticity.

He ought to know how the velocity of sound through air has been petermined, and to be well exercised in the calculation of distances by means of light and sound.

The pupil ought to know the physical difference between music and noise, and to be able to state the conditions on which the pitch and the intensity of musical sounds depend. He ought also to be able to describe various methods of producing musical sounds.

He ought to have clear ideas of the *length* of a wave, and of the *time* of a vibration. The length of a wave at a definite temperature being given he ought to be able to calculate the time of a vibration, and the time of a vibration being given he ought to be able to calculate the length of the wave.

He ought to be able to describe a method of determining from the pitch of a sound the number of vibrations per second which produce it.

He ought to know the structure of the drum of the ear, including the membranes that close it, and the bones that cross it.

He ought to know the laws of the vibration of strings, and to understand the use of sound boards in stringed instruments.

He must have a clear notion of the formation of *nodes* upon a string, by the coalescence of direct and reflected waves.

He ought also to know the laws of vibration of columns of air in both stopped and open pipes. The exact condition of the air when the fundamental notes of each class of pipes is sounded, ought to be clearly present in the pupil's mind.

The cause of beats in music ought also to be explained to the pupil, and he ought to know the range of the human ear for musical sounds.

Light.

Before entering upon the subject of light, the teacher will have been careful to make his pupil perfectly familiar with the conception of waves of sound impinging upon the tympanic membrane, and the transmission of the tremor thus produced to the auditory nerve. He need not attempt to enter upon the details of this transference to the nerve, but up to the tympanic membrane, and including it, the idea formed by the pupil of sound waves and their action must be perfectly distinct. In all cases an image must exist corresponding to the teacher's words.

He must understand that the sensation of light is caused by something that hits the optic nerve. That this something, whatever it be, passes through the humours of the eye to reach the nerve behind. The conception of light known as the emission theory can afterwards be made clear to the pupil. According to this theory a ray of light would be a train of these partieles.

That a ray of light proceeds in a straight line must be made known to the pupil. In connection with this point the inversion of objects by rays passing through small apertures must be explained.

The mode of determining the velocity of light by the eclipses of Jupiter's satellites must be explained to the pupil.

The law of inverse squares must be illustrated.

The cause of shadows and penumbrae must be explained.

The mode of determining the relative intensities of two lights by means of the "shadow test" must be explained.

The reflection of light from plane mirrors must be explained.

The pupil's attention must be drawn to the lateral inversion of objects by plane mirrors. He must know how the distance of an image behind a looking glass is affected by a change of position of the glass in a direction perpendicular to its own planes.

The relation between the angular velocity of a reflected ray and the mirror that reflects it must be explained to the pupil. The multiplication of images by angular mirrors ought also to be explained, and from it the appearances of the kaleidoscope rendered intelligible.

The formation of images by a concave spherical mirror ought to be explained to the pupil. The axis, principal focus, and centre of the mirror are to be pointed out. Beginning with a luminous point placed beyond the centre, and upon the axis, the successive positions of the image of this point during its motion along the axis from a great distance through the centre through the principal focus, up to the surface of the mirror itself must be determinable by the pupil. He will then be taught to determine the position of the images of points not placed on the axis. Objects of sensible dimensions, such as the pupil's own body, must then be substituted for points. (The teacher will avail himself of such simple apparatus as he can command in the explanations here referred to; a silver spoon, if he possesses nothing better, will be useful).

Real and *virtual foci* are to be defined.

The "aberration" of a large spherical mirror must be explained.

The refraction of light must be explained. By means of a simple geometrical construction the meaning of the "index of refraction" may be explained to the pupil without the introduction of the term "sine."

It must be clearly explained that an object looked at with a single eye appears more near the greater the divergence is of the rays which reach the eye from the various points of the object. From this it will be inferred that a lake or river, the bottom of which is visible, appears more shallow than it really is.

Various simple, but instructive illustrations of the effects of refraction will occur to the teacher, such, for example, as the rendering of a coin visible by pouring water into a basin, and the apparent bending of a straight stick thrust obliquely into water.

The circumstances under which *total reflection* occurs must be clearly explained to the pupil.

The power and action of lenses must be explained; the teacher will define the *principal focus* of a lens. As in the case of a spherical mirror, he will begin with a luminous point, determining the position and character of its image, while it moves from a great distance up to the lens itself. He will pass from points to objects of sensible dimensions, and show how the position of the image of every point of such object may be determined.

Here also *real* and *virtual foci* are to be explained.

The explanation of the magic lantern is then to be introduced.

It would add much to the efficiency of the instruction if the teacher would illustrate the points here referred to by common spectacle lenses, provided he has nothing better.

The pupil in the first class is also in a condition to know what is meant by the spherical aberration of a lens.

He must understand the optical structure of the eye, be able to give a clear account of the conditions of distinct vision, and of the causes and remedies of long and short sight.

He ought to be acquainted with the fact that impressions persist upon the retina, and to know what is meant by irradiation.

He ought to know the principles of binocular vision, and to clearly comprehend how the impression of solidity is produced by the stereoscope.

He ought to be made acquainted with the composite character of white light; and to be able to describe an experiment by which such light may be resolved into its coloured constituents.

He ought to understand the doctrine of colours as far as they are produced by absorption.

And he ought to understand the meaning of *chromatic aberration*.

Finally, it is to be stated to the pupil that according to our best knowledge the sensation of light is not produced by the impact of little particles darted out from luminous bodies; but that it is caused in a manner somewhat similar to the sensation of sound, namely, by the successive shock of minute waves against the retina.

Heat.

The pupil should know the general effect of heat upon the volumes of bodies, and should be able to describe experiments illustrative of the expansion of solids by heat. He ought also to have an idea of the almost irresistible force of this expansion.

He ought to understand with perfect clearness what is meant by the *coefficient of expansion*, linear, superficial, and cubical.

He ought to know by heart the coefficients of expansion of gold, silver, platinum, iron, and glass; and the reason why it is possible to fuse platinum wire into glass without fracture on cooling.

He ought to know the principle of Breguet's metallic thermometer, and to be made acquainted with some of the precautions which changes of volume by heat and cold render necessary in the arts.

He ought to be able to describe and explain the gridiron pendulum.

He must be able to describe the construction and explain the use of of the mercurial thermometer; the scales of Fahrenheit, Celsius, and Reaumur must be known to him, and he must be able to convert immediately the readings of any one of them into those of the other.

The dependence of the boiling point of water upon external pressure ought to be known, and the pupil must be able to give illustrations of this dependence.

He ought to know by heart the coefficients of expansion of water, alcohol, and mercury.

The pupil must be well acquainted with what is called the *maximum density* of water, to state at what temperature it occurs, and to point out its effects in nature.

He ought to be acquainted with the change of volume which occurs when water passes from the liquid to the solid state, and to apply his knowledge to the bursting of water-pipes in frosty weather. He ought to be acquainted with the fact that expansion on solidification is not a property peculiar to water.

He ought to be able to describe experiments which shall illustrate the expansion of gases. The principle and action of the fire-balloon ought to be explained to the pupil.

The general principles of ventilation ought also to be known to him, and also the sun's action in the generation of winds. He ought to be able to explain the Trade Winds.

The constancy of the coefficient of expansion of gases ought to be pointed out, with the small deviations from the general rule exhibited by carbonic and sulphurous acids. The chemical and physical character of these gases ought to be known to the pupil.

He ought to know the constitution, chemical and physical, of aqueous vapour, and how it is diffused in the atmosphere. He ought to know the meaning of the term *saturated* as applied to air charged with vapour.

The effect of expansion in chilling air ought to be known to the pupil,

and also the condensation of the aqueous vapour diffused through the air in consequence of such a chill.

He ought to be able to see the application of this knowledge to the explanation of clouds and rain.

He ought to have a perfectly clear idea of what is meant by *specific heat* or *capacity for heat*, and to be able to describe the calorimeter of Lavoisier and Laplace. He ought to know by heart the specific heats of water, alcohol, mercury, iron, and lead; and to be made aware of the influence which the high specific heat of water exercises upon climate.

He ought also to be intimately acquainted with the facts covered by the term *latent heat*. Taking a block of ice at a temperature below the freezing point, he ought to be able to describe with perfect accuracy what occurs when the temperature of the substance is raised until it liquifies, boils, and is converted into vapour.

The latent heat of water, as expressed on the Fahrenheit and centigrade scales, ought to be in the pupil's memory.

The cold of evaporation and its effect in freezing water in the cryophorus ought to be known to the pupil.

He ought to be exercised in calculations on the changes of temperature due to the mixture of steam and water in various proportions.

The pupil ought to know what is meant by the *conduction of heat*, and must be able clearly to distinguish it from the distribution of heat by *convection*. He ought to know by heart the numbers expressing the relative conductivity of gold, silver, copper, iron, and lead.

He ought to be acquainted with the low power of conduction of organic substances; to know the effect of mechanical texture on the transmission of heat, and to explain the function of clothes in preserving the body from cold.

He ought to be acquainted with the character and phenomena of combustion; to be able to explain the chemical actions which occur in the combustion of coal and of ordinary gas, and to explain the manner in which a candle flame receives its supply of combustible matter.

The combustion of the diamond and Newton's prediction regarding it ought to be known to the pupil. That animal heat is due to slow combustion ought also to be made known.

The structure of an ordinary gas flame ought to be pointed out, and the cause of the difference between this flame and that of a Bunsen's burner explained.

The pupil must be acquainted with the general phenomena of *radiant heat*. The similarity between the phenomena of radiant heat and those of light, as regards reflection and refraction, ought to be known to the pupil.

The different powers possessed by different substances to radiate heat ought to be pointed out, and this knowledge ought to be applied in explaining the striking fact that the cooling of a vessel may, under certain circumstances, be hastened by surrounding it with flannel.

The reprocity of radiation and absorption ought to be known to the pupil.

He ought also to know what is meant by the term *diathermancy*, and to be able to point how this property is manifested by different bodies.

II.—Second Stage or Advanced Course.

Questions may be set in all Subjects enumerated under the Elementary Stage, and in addition on the following topics:—

Acoustics.

The second course in acoustics includes an intimate knowledge of all the subjects mentioned in the first. In addition to this a knowledge of the following subjects will be required:—

The augmentation of the velocity of propagation of a wave of sound through air by the condensation and rarefaction of the sound wave itself.

Harmonic tones, their generation and their function in music.

The laws which regulate the transverse vibrations of rods.

The vibrations possible to a tuning fork, a disk, and a bell.

The formation of Chladni's figures.

The laws which regulate the longitudinal vibrations of strings and rods. By a comparison of the notes emitted by a rod and a column of air the pupil ought to be able to determine the relative velocities of sound through both substances.

The conditions and cause of resonance ought to be known to the pupil.

He ought also to know how sounds are produced by the vocal organs of man, and to see clearly the similarity between such sounds and those of the syren. As a case of the same kind, the construction and explanation of the Eolian harp ought also to be known to the pupil.

He ought to be well acquainted with the principles of interference as applied to sound.

He ought to be acquainted with the principles of harmony, to know the ratios of the vibrations corresponding to the notes of the gamut, to be able to give a clear account of the bearing of interference upon the question of consonance or dissonance, and to explain why those ratios which are represented by small whole numbers correspond to the most perfect harmony.

Light.

The candidate in the second course must be intimately acquainted with all the subjects mentioned in the first.

He must be able to apply his knowledge of total reflection to the explanation of the mirage of the desert.

He must be able to describe experiments by which white light may be produced by the admixture of its constituents.

He must know what is meant by *achromotism*.

He must be able to give a clear description of the undulatory theory, and to state how the colours of the spectrum are accounted for by that theory.

He must be able to define a ray of light in accordance with the undulatory theory.

He must be able to show how the reflection and refraction of light occur according to the undulatory theory.

He must be able to describe the appearances presented when incandescent metallic vapours are analysed by the prism. Especially must he be able to state what occurs when a sodium flame is thus analysed.

He must also be able to state what occurs when white light is transmitted through a sodium flame, and he must be able to describe an experiment which shall render manifest what occurs.

He must be able to state generally the relation that subsists between radiation and absorption by gases and vapours.

The lines of Fraunhofer must be known to the pupil, and from this knowledge in conjunction with the knowledge demanded by the foregoing paragraphs, he must be able to infer the probable constitution of the sun.

The pupil ought also to know the principles of interference as applied to light.

He ought to be able, in accordance with these principles, to account for the colours of thin plates and of striated surfaces.

The general principles of diffraction ought to be kn own to the pupil.

He ought to know what is meant by plane polarized light; to describe the act of polarization in the language of the undulatory theory.

He ought to know what occurs when a beam of light is transmitted through a crystal of Iceland spar; and to describe the state of the emergent light as regards polarization.

He ought to be able to describe the effects observed when light is transmitted through two plates of tourmaline cut parallel to the axis of the crystal.

He ought to be able to describe some form of the polariscope, and to state and explain by the principles of interference what occurs when a thin plate of selenite is placed between the polarizer and analyser.

Heat.

The candidate in the second course must be intimately acquainted with all the subjects introduced into the first.

He ought to be able to give a clear statement of the *mechanical theory* of heat as distinguished from the *material theory*.

He must know what is meant by the "mechanical equivalent of heat," and how it has been determined.

He must know what is meant by specific heat at constant volume and at constant pressure, and to have in his memory the numerical ratio of the two specific heats.

He ought to be able not only to explain the meaning of the difference between the two specific heats in accordance with the mechanical theory, but also to show how from this ratio the mechanical equivalent of heat may be determined.

Given the weight and velocity of a moving body he ought to be able to calculate the amount of heat generated by the stoppage of the motion.

He ought to be able to apply the conceptions of the mechanical theory to the phenomena of combustion.

He ought also to be able to show the bearing of the theory upon the phenomena of specific and latent heat.

III.—Examination for Honours.

The candidate for honours must be intimately acquainted with the foregoing two courses. He must also show himself practically acquainted with the apparatus employed in acoustics, light, and heat.

Brook's and Golding Bird's *Physics;* Ganot's *Physics;* Lardner's *Natural Philosophy;* Balfour Stewart *On Heat;* Tyndall's *Heat a mode of Motion;* Tyndall's *Lectures on Sound.*

Subject IX.—Magnetism and Electricity.

First Stage or Elementary Course.

Magnetism.

It is exceedingly desirable that the pupil's ideas of the fundamental facts and principles of magnetism should be as clear as our knowledge and his capacity can make them.

He ought to be made acquainted with the action of the natural magnet or loadstone on small pieces of iron. This is to be mentioned to him as the first fact observed, but for the explanation of which other facts are necessary. The action of two natural magnets upon each other ought to be described, and through this action a clear notion of the doctrine of *magnetic polarity* ought to be conveyed to the pupil's mind.

The power of the natural magnet to confer its own magnetic properties

upon steel, and the action of the natural magnet on the steel which it has magnetised, ought to be explained.

The action of two pieces of magnetised steel upon each other ought to be made clear, and from this action the fundamental law that like poles repel each other, and that unlike poles attract each other, ought to be deduced.

The distribution of magnetism in a bar magnet ought to be made clear. The effect of breaking the magnet into two halves; the effect of again breaking these halves; and through facts of this nature, a clear idea is to be conveyed that each molecule of the magnet is itself a magnet; the action of the magnet as a whole being the sum of the actions of its molecules.

It is of exceeding importance that the pupil should be taught to connect the facts of magnetism by means of the provisional conception known as *the theory of magnetic fluids*. The teacher will assure himself that a correct image of this theory is in the pupil's mind. He will at the same time be careful to inform the pupil that the theory is an image merely, which enables him to connect and classify his facts, and that it is not a proved scientific truth.

The theory is to be applied in explaining the difference between iron and steel as regards their power of accepting and retaining magnetism. The term *coercive force* and all that relates to it will here come under review.

The theory is also to be applied in explaining the first observed facts of magnetism, including in them, and illustrating by them the general phenomena of magnetic induction, or magnetization by influence. Every student ought to have a clear image of the state of a piece of iron acted on by a magnet, and he ought to be able to explain why the attraction of the iron is a consequence of that state. He ought clearly to see that repulsion as well as attraction is at work, the resultant attraction being the difference of both.

He ought to understand that when the attracting magnet is very distant, the difference between attraction and repulsion is so small as to be imperceptible; this knowledge will render it easy for him to comprehend why the magnetic poles of the earth which give *direction* to a magnetic needle are incompetent to produce a motion of translation.

The pupil ought to know the facts of terrestrial magnetism; why it is that we consider the earth a magnet. It will be possible to make him acquainted with all that is known regarding the position of the earth's magnetic equator and of the terrestrial magnetic poles.

The terms declination (variation), inclination (dip), and magnetic intensity, ought to be explained to him.

Electricity (frictional).

Here also care must be taken to imprint the fundamental facts and principles clearly and firmly upon the pupil's mind. It is easy in the case of frictional electricity to let the pupil actually see some of the facts; and it is exceedingly desirable that he should do so. The same remark applies to the elementary facts of magnetism.

As in the case of magnetism, the fact first observed, namely, the attraction of light bodies by rubbed amber, must be shown to need other facts for its explanation.

The mode of exciting bodies by friction is to be described; the action of rubbed and unrubbed vitreous bodies upon each other; the action of rubbed and unrubbed resinous bodies upon each other; and the action of vitreous bodies upon resinous bodies, and the reverse, are to be clearly described and illustrated. From these facts the law is to be deduced

that bodies similarly electrified repel, and dissimilarly electrified attract, each other. The pupil ought to know why the terms vitreous and resinous, as applied to electricity, have been abandoned.

Having been made acquainted with the elementary facts and principles, the pupil is to be rendered familiar with the provisional conception called the theory of electric fluids. As in the case of magnetism, he is to understand that this theory is an image merely, and not a truth.

He ought to be made acquainted, by experiments performed or described, with the qualities of insulation and conduction. He ought to know the reason of the old division of bodies into electrics and non-electrics, and also the unsound character of this classification.

Clear definitions ought to be given as to what is to be understood by positive and what by negative electricity. The pupil must be able to determine the quality of the electricity with which any body is charged.

He must be thoroughly versed in the phenomena of electric induction, and must be able to apply the theory of electric fluids in the explanation of these phenomena. In connexion with the subject of electricity this is the most important part of the teacher's duty, for upon a knowledge of the facts and principles of electric induction the comprehension of almost all that follows it depends.

The pupil ought to be able to construct, or describe the construction, of an electrophorus, and to explain its action by reference to the principles of electric induction.

He ought to be able to explain the condenser by reference to the same principles.

He ought to be able to explain the charging and discharging of the Leyden jar by reference to the same principles.

He ought to be able to describe the charging of the prime conductor of an electric machine by reference to the same principles.

The knowledge implied in the last three questions embraces that of the construction of the condenser, the Leyden jar, and the electric machine. The first form of the Leyden jar ought to be known to the pupil.

The distribution of electricity on the surfaces of conductors is to be made known, and from it the power of points to disperse electricity ought to be deduced. The pupil ought to realize that in virtue of its self-repelling character an electric fluid always moves to the external surfaces of bodies. The power of flames in dispersing electricity ought also to be made known to the pupil.

He will now be ready to understand the form and theory of lightning conductors.

The physiological, deflagrating, and mechanical effects of the electric discharge ought to be known to the pupil. He ought also to be able to apply his knowledge to the explanation of thunder and lightning, and of the return shock.

Voltaic Electricity.

The simplest combinations for the generation of a voltaic current ought to be made known to the pupil. The electric state of the free ends of the two metals immersed in the exciting liquid ought to be described; he ought to be taught to apply the theory of electric fluids to the conception of two currents flowing in opposite directions, and then the omission of one of these currents as a matter of convenience ought to be made known.

It is very important that the pupil should have a clear physical image of the fundamental phenomena before his mind. As in cases formerly referred to, the teacher will be careful to explain that this

idea of a fluid flowing in a current is an image merely, and not a proved truth.

Galvani's experiment with the legs of the frog which he suspended by a copper hook on an iron railing ought to be explained; and also the experiment of Sulzer, where the tongue is placed between two metals.

The bearing of the experiment illustrating "the return shock" on Galvani's first observation ought to be explained.

The idea of an electro-motive force separating the two electricities and driving them in opposite directions ought to be distinct in the pupil's mind.

He ought to be made acquainted with the magnetical effects of the circuit, with the action of a current upon iron filings, with its action upon a freely suspended magnetic needle. In this latter action he is to be particularly well versed, so as to be able immediately from the deflection of the needle to infer the direction of the current, and from the direction of the current the deflection of the needle.

He must know the action of a current upon a bar of iron placed within a coil round which a current circulates. He must understand the magnetic properties both of the coil and of the bar.

He ought to be made acquainted with the simplest form of the multiplying galvanometer.

He ought to understand the principles of the needle telegraph.

Some of the chemical effects of the current ought to be made known to the pupil. He ought, for example, to have a distinct notion of the composition of water, and an equally distinct notion of its decomposition by the electric current.

Second Stage or Advanced Course.

Magnetism.

The more advanced pupils that undertake the second course ought to be intimately acquainted with all the subjects introduced into the first. The following additional subjects are to be mastered.

The disposition of the so-called magnetic curves round a bar magnet, round two bar magnets with similar or unlike poles adjacent to each other, and round a horse-shoe magnet, must be clearly understood. The pupil must know how a short magnetic needle, or of a short bar of iron freely suspended acts in relation to those lines, and he must be able to show that the lines are deducible from the doctrine of magnetic polarity combined with elementary mechanical conceptions.

He must be able to figure mentally the magnetic curves of the earth, and to see their relation to the line of dip.

He must have perfectly clear notions as to what is meant by the strength of a magnet. He must be able to compare the strength of magnets together, by the method of oscillation, by the torsion balance, or by the deflection of a small magnetic needle.

A knowledge of the principles and use of the torsion balance is quite essential.

He must know what is meant by the law of inverse squares, and be able to show how it has been experimentally demonstrated.

The pupil must be acquainted with the effect of temperature and of percussion upon a magnet.

He must know the meaning of the terms horizontal intensity, vertical intensity, and total force. He ought also to know what is meant by the variation of all of those, that they are different at different parts of the earth's surface, at different hours of the day, at different seasons of the year. To a knowledge of the diurnal and annual variations, he ought to add a knowledge of the secular variation.

Electricity (frictional).

The more advanced pupil must be intimately acquainted with all the subjects introduced into the first course.

He must understand the cascade arrangement of the Leyden battery, as contrasted with the ordinary arrangement.

He must understand the application of the torsion balance to the measurement of electric force.

He ought to be able to think out and describe various new and simple forms of the condenser and the Leyden jar.

He ought to be able to carry forward the idea of an electric fluid to the conception of a current of such fluid; he ought to be able to describe the chemical and magnetical effects of such a current. He ought to be able clearly to contrast those actions as manifested by frictional electricity with the same actions as manifested by voltaic electricity.

He ought to be able to describe the experimental arrangements necessary to the production of primary, secondary, tertiary, and currents of higher order by the discharge of the electric battery.

He must understand the law of inverse squares as applied to electricity, and clearly comprehend its limitations.

The diurnal variation of atmospheric electricity ought to be known to the pupil.

The application of the unit jar in the measurement of electric charges ought to be known to the pupil.

The terms quantity and intensity (or as it is called by some *density*) as applied to electricity ought to be clearly understood. The relation of the heating power of an electric discharge to its quantity and intensity ought also to be known to the pupil.

Voltaic Electricity.

The more advanced pupil must be intimately acquainted with the subjects mentioned in the first course.

To the electro-magnetical knowledge there demanded he is to add the knowledge of determining the strength of a current by the deflection of a magnetic needle.

He ought also to be able to determine the relative strength of two currents by their chemical action.

He ought to know how the magnetism of a bar of iron augments in intensity as the currents which surround it augments in strength.

He ought to know how the *attraction* of iron by an electro-magnet augments as the exciting current is augmented. In this case he ought to see and be able to describe the difference between a piece of soft iron and a piece of exceedingly hard magnetized steel.

He ought to be acquainted with induced currents, their various modes of generation, and their laws of action.

He ought to be able to explain the ordinary madical magneto-electric coil. He ought also to be able to describe Ruhmkorfo's coil, and some of the effects obtainable by it.

He ought to be able to sketch a current reverser.

He ought to understand the principles of the astatic needle.

He ought to be able to describe the phenomena of the extra-current.

He ought to be made acquainted with the mutual action of currents upon each other, with the attractions and repulsions which are dependent upon direction.

He ought to know how a coil of copper wire may be suspended so that

when a current flows through the wire it shall, like a magnetic needle, obey the directive action of the earth.

He ought to be acquainted with the principles of electro-plating, adding to a knowledge of the decomposition of water a knowledge of other decompositions, by which conducting surfaces may be coated with copper, silver, or gold.

He ought also to be made acquainted with the chemical actions that occur within a voltaic cell when the current circulates.

The arrangement of cells into batteries ought to be described. The pupil ought to be made acquainted with the *pile* of Volta and the *crown of cups*. He ought also to have explained to him the battery of Grove.

The reason for employing two fluids in the cells of this battery ought to be explained.

The dependence of the heat generated on the resistance overcome by the current ought to be made known. He ought to be taught to form as definite a conception as possible of resistance in relation to electromotive force, and to understand the formula which expresses the relation of heat, resistance, and current strength.

He ought to understand the theory of molecular currents, and to be able to apply this theory in explanation of the phenomena of magnetism.

Examination for Honours.

A candidate who enters the honours examination must be intimately acquainted with the foregoing two courses in magnetism. In addition to this he must be able to show that he has a competent practical knowledge of the apparatus employed. He must show ability in devising and executing experiments, and ought to be able in the presence of the examiner to perform experiments illustrative of any or all of the subjects introduced in the foregoing two courses.

The candidate ought also to know the facts and principles of diamagnetism. He ought also to be able to describe and explain the deportment of crystalline bodies between the poles of a magnet.

In frictional electricity, besides an intimate acquaintance with both of the foregoing courses, the candidate must possess a competent practical knowledge of the apparatus employed. He must be able to devise and execute experiments in the examiner's presence. He must be intimately acquainted with the experiments with a rotating mirror by which Wheatstone determined the velocity of electricity and the duration of the electric spark.

Voltaic Electricity.

Besides being intimately acquainted with the two foregoing courses, the candidate must have a practical acquaintance with the apparatus employed in voltaic electricity.

He must be intimately acquainted with the laws of Ohm which express the relation of electro-motive force, internal and external resistance, and current strength.

He must be able to apply the principles of the dynamical theory of heat to the heat phenomena of the voltaic current. He must be clearly informed as to the manner in which the heat is distributed within and without the battery.

Brooks and Golding Bird's *Physics;* Ganot's *Physics;* Lardner's *Natural Philosophy;* Ferguson's *Electricity.*

Subject X.—Inorganic Chemistry.

First Stage or Elementary Course.

Pupils presenting themselves for examination will be expected to possess a knowledge of the following subjects :—

Definition of chemistry. Simple and compound matter. Different modes of chemical action. Combining weights. Volume weights. Principles of chemical nomenclature. Symbolic notation. Graphic notation. Chemical formulæ. Chemical equations. Atomicity of elements. Simple and compound radicals. Definition of a compound radical. Classification of elements into metals and non-metals, into chlorous and basylous elements. Classification according to atomicity.

French and English systems of weights and measures. Conversion of English into French weights and measures. The crith and its uses.

Hydrogen.—Its preparation and properties.

Chlorine.—Preparation of chlorine from hydrochloric acid. Analysis and synthesis of hydrochloric acid. Properties and reactions of hydrochloric acid.

Oxygen.—Its preparation and properties. Allotropic oxygen or ozone. Formation and reactions of water. Preparation and properties of hydroxyl. Oxides and oxacids of chlorine.

Boron.—How it occurs in nature. Its allotropic modifications. Boric anhydride. Boric acids.

Carbon.—Its preparation and allotropic forms. Preparation and properties of carbonic oxide and carbonic anhydride.

Nitrogen.—Its preparation and properties. Oxides and oxacids of nitrogen. Compound of nitrogen with hydrogen. Ammonia. Ammonic salts.

Sulphur.—Its properties and allotropic modifications. Compounds of sulphur with basylous elements. Compounds of sulphur with oxygen and hydroxyl.

Second Stage or Advanced Course.

In addition to the above subjects, pupils presenting themselves for the advanced examination will be assumed to have received instruction in the following :—

Theory of atoms and molecules. Empirical, rational, and constitutional formulæ. Absolute, latent, and active atomicity. Atomic and molecular combination.

Expansion of gases by heat. Reduction of gaseous volumes to standard pressure and temperature.

Manufacture of hydrochloric, nitric and sulphuric acids. Composition and manufacture of bleaching powder. Theory of bleaching. Suitability of water for domestic purposes. Causes of permanent and temporary hardness in water.

Bromine.—Hydrobromic and bromic acid.

Iodine.—Hydriodic, iodic, and periodic acid.

Fluorine.—Hydrofluoric acid.

Silicon.—Silica. Silicic acid. Silicic hydride. Names and formulæ of some of the more important silicious minerals.

Phosphorus.—Phosphoretted hydrogen. Acids and anhydrides of phosphorus.

Arsenic.—Arsenious and arsenic acids. Arseniuretted hydrogen. Detection of arsenic.

Antimony and Bismuth.—Preparation and properties of their chief compounds.

The monad metals, especially potassium, sodium, and silver. Manufacture of soda-ash.

The dyad metals. Barium, strontium, calcium, magnesium, zinc, cadmium, mercury, and copper.

The chief properties of the following metals:—Gold, aluminium, platinum, lead, chromium, manganese, iron, cobalt, and nickel.

Composition, preparation and properties of the more important compounds of these metals.

Outline of qualitative analysis. Reactions of the principal mineral acids and bases. Course pursued in the application of these reactions to the analysis of a mixture of several acids and bases.

Examination for Honours.

In addition to the above, candidates are expected to possess a knowledge of the following subjects:—

Theory of normal, acid, and basic salts. Constitutional formulæ of the various acids of phosphorus. Monatomic and polyatomic molecules.

The phenomena of combustion.—Thermal units. Absolute thermal effect, or total amount of heat evolved by various kinds of fuel and other combustibles. Pyrometric thermal effect, or intensity of heat evolved by combustibles. Translation of absolute thermal effect into its mechanical equivalent. Theory of flame. Source of light in luminous flames. Spectrum analysis, its principles and applications. Relations of specific heat to atomic weight.

The law of the diffusion of gases. The laws of electrolysis. The processes used in the quantitative analysis of the more commonly occurring minerals.

For preparation for examination in the above syllabus, the following works are recommended as text books:—

Lecture Notes for Chemical Students, by E. Frankland, 8vo., 12*s*. (London, Van Voorst, 1866.)

First Principles of Modern Chemistry, by U. J. Kay Shuttleworth, 8vo., 4*s*. 6*d*. (London, Churchill, 1868.)

Introduction to Modern Chemistry, by A. W. Hofmann, 8vo., 4*s*. 6*d*. (London, Walton, 1865.)

First Step in Chemistry, by R. Galloway, 12mo. 5*s*. (London, Churchill, 3rd ed., 1860.)

Lessons in Elementary Chemistry, by H. E. Roscoe, 18mo., 4*s*. 6*d*. (London, Macmillian, new ed., 1867.)

For the advanced course the following may be used in addition to the above:—

Chemistry, Inorganic and Organic, by C. L. Bloxam, 8vo. 16*s*. (London, Churchill, 1867.)

Manual of Elementary Chemistry, by G. Fownes, 12mo., 12*s*. 6*d*. (London, Churchill, 9th ed., 1863.)

Elements of Inorganic Chemistry, by W. A. Miller, 8vo., 21*s*. (London, Longman, 3rd ed., 1864.)

Chemistry for Students, by A. W. Williamson, 12mo., 7*s*. 6*d*. (London, Macmillan, 1865.)

Qualitative Analysis, by R. Galloway, 8vo., 6*s*. 6*d*. (London, Churchill, 4th ed., 1864.)

Besides these works the following are recommended for reading for honours:—

Second Step in Chemistry, by R. Galloway, 12mo. 10*s*. (London, Churchill, 1863.)

Chemical Physics, by W. A. Miller, 8vo. 15*s*.
(London, Longman, 4th ed., 1867.)

Dictionary of Chemistry, and the Allied Branches, by H. Watts, in four Vols., 8vo., 1st Vol., 31*s*. 6*d*., 2nd Vol., 26*s*., 3rd Vol., 31*s*. 6*d*., 4th Vol., 24*s*. (London, Longman, 1863–66.)

Elementary Treatise on Heat, by Balfour Stewart, 12mo., 7*s*. 6*d*.
(London, Macmillan, 1866.)

Heat considered as a Mode of Motion, by J. Tyndall, 8vo., 12*s*. 6*d*.
(London, Longman, 2nd ed., 1866.)

Subject XI.—Organic Chemistry.

First Stage or Elementary Course.

Pupils presenting themselves for examination will be expected to possess a knowledge of the following subjects:—

Definition of organic bodies; their ultimate analysis. Calculation of empirical formulæ. Compound organic radicals. Notation of organic compounds. Graphic and symbolic formulæ.

Organic Radicals.—Basylous or positive radicals. Preparation and properties of the monad radicals of the methyl series. Monad radicals of the vinyl and phenyl series.

Dyad basylous radicals of the ethylene series. Preparation and properties of ethylene.

Chlorous or negative radicals. Cyanogen. Oxatyl. Oxalic acid, its preparation and properties.

Hydrides of the Organic Radicals.—Methylic hydride or marsh gas. Paraffin. Benzol. Cyanic hydride or hydrocyanic acid. Oxatylic hydride or formic acid.

The Alcohols.—Definition of an alcohol. Methylic alcohol. Ethylic or common alcohol. Phenylic alcohol or carbolic acid.

The Ethers.—Definition. Preparation and properties of ethylic ether.

The Haloid Ethers.—Their constitution. Preparation and properties of ethylic chloride and iodide.

The Aldehydes.—Their nature and properties. Acetic aldehyde. Benzoic aldehyde or oil of bitter almonds.

The Acids.—Definition of an organic acid. Acetic acid. Lactic acid, Benzoic acid.

Ethereal Salts.—Definition and constitution of the ethereal salts of the monobasic acids. Preparation and properties of acetic ether and butyric ether.

Second Stage or Advanced Course.

In addition to the above subjects, students presenting themselves for this examination will be assumed to be acquainted with the following:—

Determination of the rational formulæ of organic acids and bases. Graphic and symbolic types of organic compounds. Reduction and development of the formulæ of organic bodies. Classification of organic compounds.

Organic Radicals.—Dyad basylous radicals of the acetylene series. Single and double cyanides. Manufacture of prussian blue and of oxalic acid.

Hydrides of the Organic Radicals.—Ethylic and amylic hydrides. Hydrides of the radicals of the phenyl series. Manufacture of coal-gas.

The Alcohols.—Classification, preparation and properties of alcohols. 1. Monacid alcohols; methyl series, vinyl series, allyl series, phenyl

series. 2. Diacid alcohols or glycols; ethylic glycol and its derivatives. 3. Triacid alcohols; glycerin, its preparation and properties.

The Ethers.—1. Ethers of the monacid alcohols;—methylic ether, allylic ether, phenylic ether. 2. Ethers of the diacid alcohols;—ethylenic oxide. 3. Ethers of the triacid alcohols;—glycylic ether.

The Haloid Ethers.—Haloid ethers of the monad, dyad, and triad positive radicals. Methylic chloride. Manufacture of chloroform. Ethylenic bromide.

The Aldehydes.—Formation and re-actions of the aldehydes of the methyl, vinyl, and phenyl series of alcohols.

The Acids.—Law of basicity of organic acids.

Monobasic acids:—Acetic or fatty series. Acrylic or oleic series. Lactic series. Pyruvic series. Glyoxylic series. Benzoic or aromatic series.

Dibasic acids:—Succinic series. Fumaric or acryloid series. Malic or lactoid series. Tartaric or glyoxyloid series.

The Anhydrides.—Definition and constitution of the anhydrides. Formation and re-actions of the anhydrides of monohydric monobasic acids, dihydric monobasic acids, and of dihydric dibasic acids.

The Ketones.—Derivation and constitution of the ketones. Preparation and properties of acetone.

Ethereal Salts.—Ethereal salts of dibasic and tribasic acids, and of monacid, diacid, and triacid alcohols.

Organic Compounds containing Nitrogen, Phosphorus, Arsenic and Antimony.—The more important natural and artificial alkaloids. Extraction of quinine from cinchona bark.

Organometallic Bodies.—Definition. Their behaviour and formation. Preparation and properties of zincic ethide, mercuric ethide and stannic ethide.

Examination for Honours.

In addition to the above, the candidate should be well acquainted with the following subjects:—

Determination of the specific gravity of gases and vapours. The methods employed in the analysis of gaseous organic bodies. Synthesis of organic compounds. Determination of the constitutional formulæ of organic bodies. Isomerism, metamerism and polymerism in organic bodies.

Organic Radicals.—Normal, secondary, and tertiary monad radicals. Isomerism of ethylene and ethylidene compounds. Relations between methyl, oxatyl and cyanogen.

Hydrides of the Organic Radicals.—Relations of the basylous monad radicals to their hydrides.

The Alcohols.—Relations of the normal monacid alcohols to the monad C_nH_{2n+1} radicals, the dyad C_nH_{2n} radicals, and to the hydrides of the $C_n H_{2n+1}$ radicals.

Secondary monacid alcohols. Isopropylic, pseudamylic and pseudohexylic alcohols.

Tertiary monacid alcohols. Pseudobutylic alcohol.

Normal and secondary alcohols of the phenyl series.

Relations of glycerin to isopropylic and allylic alcohol; also to glyceric, tartronic, and acrylic acid.

Other polyacid alcohols:—Erythrite, mannite, glucose.

The Acids.—Difference between hydricity and basicity of acids.

Normal, secondary, and tertiary fatty acids. Relations of the fatty acids to the C_nH_{2n+1} series of radicals, and to the $C_nH_{2n+1}Ho$ series of alcohols. Relations of the fatty acids to each other; ascent of the series.

Normal, secondary, and olefine acids of the acrylic or oleic series. Relations of the acrylic to the acetic series of acids.

Definition and classification of the acids belonging to the lactic series Relations of the lactic to the fatty and acrylic series of acids. Isomerism in the lactic series.

Relations of the pyruvic series of acids to the oxalic and lactic series.

Relations of the glyoxylic series of acids to the glycerin series of alcohols.

Constitution and classification of the dibasic acids. Relations of the succinic series of acids to the lactic and acetic series, and to the glycols.

Isomerism in the fumaric series of dibasic acids.

Tartaric or glyoxyloid series of dibasic acids. Varieties of tartaric acid.

Constitution and classification of the tribasic acids.

The Ketones.—Isomerism in the ketone family.

Organic Compounds containing Nitrogen, Phosphorus, Arsenic, and Antimony.—The amines, phosphines, arsines, and stibines. Primary, secondary, and tertiary organic bases. Monamines, diamines, triamines, and tetramines.

Organometallic Bodies.—Their constitution and its bearing upon the doctrines of atomicity.

In addition to such of the works as treat on Organic Chemistry recommended in the Syllabus of Subject X., the student's attention is drawn to the following :—

Elements of Organic Chemistry, by W. A. Miller, 8vo., 24*s*.
(London, Longman, 3rd ed., 1866.)

Subject XII.—Geology.

I. First Stage or Elementary Course.

A.—Preliminary Subjects.

a. Basis of Geology.—Definition of the objects of geology. Waste of land now going on by mechanical causes,—rain, running water, frost, snow, glaciers, and by the sea. Origin of rounded pebbles, grains of sand, and mud. Sediments carried in mechanical suspension in rivers. Deposition of strata now forming in the sea and in lakes from sediments formed mechanically. Other strata formed in part or entirely of organic remains, and how they are preserved. Proof that stratified rocks generally were formed by deposition from water, as above, and that strata have been successively deposited and are of ages less or more apart. Definition of the term igneous as applied to rocks.

b. Common Geological terms.—Definition of "crust of the earth," clay, sand, gravel, shale, sandstone, conglomerate, breccia, limestone, lava, volcanic ashes, stratum or bed, *a formation*, group of formations. Recent, Cainozoic (tertiary), Mesozoic (secondary), and Palæozoic formations. Horizontal, inclined, vertical strata. Anticlinal and synclinal curves. Contorted strata, dip, strike, outcrop, a basin. Conformable and unconformable stratification, joint, slaty cleavage, fault, lode, vein. Names of some of the metamorphic rocks.

c. Composition of principal rocks and their common minerals.—Minerals that form granites and granitic rocks; Syenites, Diorites (greenstones), Basalts, Dolerite, gneissic rocks, limestones. Coal, what originally formed from. Colouring matter of rocks.

d. Disintegration and Solutions.—Disintegration, and solutions of minerals composing rocks by means of acids; mineral springs, and substances in chemical solution in rivers, lakes, and the sea. How produced.

e. Snow and Ice.—How glaciers are formed from snow. Movement of glaciers and transport of matter on their surfaces. Moraines. Erosion of rocks, over which glaciers flow. Icebergs, whence derived. Transport of matter from cold to warmer latitudes by icebergs.

f. Rivers.—Cutting out of terraces *and valleys* by rivers. Transport of material seaward, and gradual growth of Deltas.

g. Marine Denudation, Transport and Consolidation of Material and Fossilization.—Waste of sea coasts by breakers and by help of landslips. Rounding of pebbles and grains of sand on shores and in streams. The effect of long continued marine denudation on the land; formation of bays and head-lands, &c. Distribution of sediments derived from land over sea bottoms, forming modern marine strata. Consolidation of strata by pressure, chemical changes and heat. Preservation of shells, &c., in seas, lakes, and delta deposits, in alluvium, and in and under peat, blown sand, and volcanic ashes.

h. Central Heat, Volcanos, Earthquakes, and other Movements of the Earth's Crust.—The connexion of the corals reefs of the Pacific Ocean with the gradual sinking of the sea bottom. Fringing reefs, barrier reefs, atolls. Volcanos and their connexion with some areas of upheaval of land above the sea. Raised beaches and sea bottoms. The structure of volcanos. The wave-like motion of earthquakes. General structure of mountain chains. The existence of so-called central heat in the earth. Change of common strata, such as shale and slate, sandstone, limestone, &c., into mica-schist, gneiss, quartz rock, crystalline limestone, &c. (metamorphism).

B.—Classification of Animal and Vegetable Life.

i. A rudimentary acquaintance with the meaning of the names of those CLASSES of animals and plants that are or may be found fossil, such as Mammalia, Aves (birds), Reptilia, Pisces (fish), Insecta, Myriapoda (centipeds, &c.), Arachnida (spiders, &c.), Crustacea (crabs, &c.), Annelida (worms, &c.), Echinodermata (sea-urchins, starfish, &c.), Cephalopoda (cuttle-fishes, &c.), Pteropoda, Pulmonata (land snails, &c.), Gasteropoda (periwinkles, limpets, &c.), Conchifera (oysters, cockles, &c.), Brachiopoda (terebratula, &c.), corals, sponges. The Vegetable Kingdom: the names of the classes and orders of plants.

Succession of Strata, Igneous Rocks, &c.

C.—Palæozoic Series.

k. Oldest known stata or the Laurentian rocks. Their metamorphic character. Oldest known fossil. Huronian rocks of Canada.

l. Cambrian and Silurian strata.—Cambrian rocks, and their traces of fossils. Lingula flags and Tremadoc slates. Llandeilo and Bala beds, and the lavas and volcanic ashes associated with them. Llandovery or Pentamerus beds. Upper Silurian series. Leading kinds of fossils common in these formations, such as the genera of Graptolites, Corals, Brachiopoda, Conchifera, Cephalopoda (chambered shells), Echinodermata, Crustacea (especially the Trilobites), and first appearance of fish remains and land plants.

m. Old Red Sandstone and Devonian strata.—The areas in Britain that formed land before the deposition of the Old Red Sandstone. Unconformities of Old Red Sandstone on older rocks. Division into lower and upper Old Red Sandstone and unconformity. The nature of the rocks. The fish found in the lower, and the fish, fresh-water shells and plants in the upper Old Red Sandstone. *Devonian strata.*—Commonly divided into lower, middle, and upper. Their marine fauna, corals, shells bivalve and univalve, Goniatites and other cephalopoda, Trilobites, &c. Difference between the Silurian and Devonian genera and species.

n. Carboniferous strata.—The ordinary succession of these strata in Wales and the South of England (See also parts of 16 in Advanced Stage). The kinds of corals, shells, and fish found in the Carboniferous Limestone, and other beds. The kind of sections found in the *Coal-measures.* The Underclay generally below beds of coal. How coal was formed from fossilized plants. How there came to be many beds of coal in one coal-field with beds of shale, ironstone, and sandstone between.

o. Permian formations.—Their succession in England and Germany, and the proofs of their unconformity on the Carboniferous strata. The structure of the Rothliegende or Brecciated Conglomerates, the Marl-slate or Kupferschiefer, the Magnesian limestone (Zechstein). Their fossils.

D.—Mesozoic or Secondary Series.

Lower Mesozoic.

p. New Red Sandstone or Trias.—British divisions: 1st. New Red Sandstone (Bunter); 2nd. New Red Marle (Keuper). Continental divisions. New Red Sandstone, Muschelkalk, New Red Marle. Unconformity on Permian and older rocks. Great changes of life in passing from Palæozoic to Mesozoic times. Change in the relative numbers of Brachiopoda and Conchifera when compared with Palæozoic rocks, and continuation of this down to present day. New Cephalopoda, encrinites, fish, and reptiles. First known mammal. Plants of the Keuper sandstone, crustacea, reptiles, &c. Origin of rock-salt by evaporation. Gypsum of red marle. Parts of what is now the British Islands that formed land before the deposition of the Trias.

q. Rhætic or Penarth beds.—(See 19, p. 80.)

r. Lias formations and Oolites.—(Jurassic of the continent). Division into Lower, Middle, and Upper Lias, and Lower, Middle, and Upper Oolites. The names of the formations included in each of these. Characters of the rocks. Great development of life of these periods. Leading marine fossils of the Lias and land plants and insects. Common genera of Brachiopoda and Conchifera, Gasteropoda, Cephalopoda, Echinodermata, Fish, and Reptiles. Leading fossils of the Oolites as above, and also Mammalia. Proofs of land in the neighbourhood of the British Liassic, and Oolitic seas.

s. Purbeck and Wealden strata.—Their estuarine character, and proofs of this from the fossils. Generic names of leading fossils. Proofs of the existence of a neighbouring large continent.

Upper Mesozoic.

t. Cretaceous series.—British divisions, Lower and Upper and their subdivisions. The nature of the strata and general grouping of fossils (as in *r* above). Differences when compared with Oolitic genera and species.

Uppermost Cretaceous beds absent in Britain, viz. the Maestricht and Faxoe beds and the beds of Aix-la-Chapelle. Account of these.

E. Cainozoic or Tertiary Series.

u. Eocene or Lower Tertiary.—Meaning of the terms Eocene, Miocene, and Pliocene. Areas occupied by the English and French Eocene strata, and divisions of the English Eocene strata. Their fossils, freshwater, estuarine, and marine. Proofs of neighbouring land in freshwater shells, plants, and terrestrial mammalia.

v. Miocene or Middle Tertiary, of Bovey-Tracey, Mull, &c. French marine strata and freshwater and volcanic formations. The kinds of fossils they contain. The Swiss, Italian, and other continental beds. The floras of the period, insects, mammalia, reptiles, shells, &c. The Arctic Miocene beds, and flora. Indian Miocene strata and their fossils.

w. Post-Pliocene strata, Crag, &c.—Divisions of the British Crag, characters, and fossils, marine and terrestrial. Economic products. Crag of Belgium. Proportions of recent species in the different members of the Crag. Sub-Appenine strata and those of Sicily.

x. Glacial period and other strata later than the Crag.—The Forest beds beneath the boulder clay, and the union of Britain with the continent, and its Flora, terrestrial Fauna, and shells. (See also 26, p. 82.) The glaciers of the glacial period, before, during, and after the deposition of the marine boulder clays. The origin and nature of the boulder clay. Other proofs of a cold climate, and the marine and terrestrial Fauna of the period.

II.—Second Stage or Advanced Course.

A.—Preliminary Subjects or Principles.

1. All contained in *a* of the elementary stage.

2. All contained in *b*.

3. All contained in *c*, and the chemical constituents of silica, various felspars, micas, augite, diallage, hornblende, garnet, obsidian, pitchstone, pumice. Limestone, Magnesian limestones or Dolomite. Coals, such as common house and furnace coals, cannel coals, and anthracites. Iron ores. The colouring matter of rocks. The general relative proportions in the known crust of the earth of mineral substances, such as silica, alumina, lime, magnesia, iron, &c., &c.

4. *Chemical disintegration.*—Chemical disintegration of rocks on a large scale; formation of kaolin, fireclays and other clays and shales. Origin of mineral springs, and substances in solution in rivers, seas, and other waters. Skeletons of shell fish and other marine and fresh water animals, whence derived, and how strata are formed of these.

5. *Effects of snow and ice.* — What is a glacier, and how formed. Change of snow into solid ice. Stratification and veined structure of ice. Inclinations of beds and surfaces of glaciers. Why glaciers flow. Rates of progress. Crevasses. Moraines, lateral, medial, terminal, and how they are formed. Erosion of rocks under glaciers and its results. Flow of water from lower ends of glaciers. Destruction of terminal moraines, and circumstances that induce their occasional preservation. Oscillation of size of glaciers. Deepening of valleys. Signs left by glaciers that have disappeared. Icebergs of Arctic and Antarctic regions and of South America; how formed. Ocean currents. Transport of matter by icebergs, and its distribution over existing sea bottoms. Transport of detritus by coast ice and river ice.

6. *Landslips.*—Landslips in mountainous and hilly regions, and landslips on sea coasts. Their effect in bringing matter within the influence of running water and of the sea.

7. *Rivers.*—Erosive and transporting power of brooks and rivers. Their influence in forming gorges and valleys. Origin of waterfalls. Amount of matter carried seaward by great rivers such as the Nile, the Ganges, the Mississippi, &c. The mode of formation and gradual growth of deltas and their possible age. Filling up of lakes by sediments. General effects on the form of the ground and lowering of level of continental and smaller areas by combined effects of chemical disintegration, rain, rivers, frost, snow, and glacier ice.

8. *Marine denudation.*—Waste of sea coasts by breakers and landslips. Formation of pebbles and sand on sea coasts. Amount and nature of waste of boulder clays of eastern coasts of England, &c.; of Tertiary strata, and of Cretaceous and Oolitic strata on east and south coasts. Waste of harder rocks of west of England, Wales, and Scotland. Power of breakers in moving sand and shingle, and large blocks of stone. Effect of prevalent winds on waste and transport of material along shores. Silting up of estuaries. Effect of groins and other artificial obstructions on coasts. Warping of alluvial tidal flats. Forms of sea cliffs and origin of many bays and headlands. Origin of great plains of marine denudation by combined action of breakers, landslips, and general lowering by waste of the interior of countries. Subsequent upheaval of such plains and renewed scooping out of valleys. Origin of certain tablelands and their valleys.

9. *Distribution of Material in Sea, &c. forming Modern Strata.*—Transport of matter by great marine currents, passing mouths of rivers and along coasts. Transporting powers of tidal currents. Sifting action of the sea in arranging sediments along its bottom. Icebergs (see 5). Modern formation by above causes of beds of clay, sand, gravel, and boulder beds, and mixtures of these. Volcanic ashes falling in sea and lakes. General formation of lacustrine strata. Formation of beds of limestone by organic bodies in seas, lakes, and lagoons. Coral reefs (see 10). Salts carried in solution in rivers into lakes, evaporation of surplus water, concentration and precipitation. Origin of rock salt, &c.

10. *Fossilization and Consolidation of Strata.*—Shells and other marine organic remains buried in sediments. Also terrestrial plants. Worm burrows. Terrestrial animals. Organic remains in lakes and river deltas, in alluvial beds and brickearths; in and under peat, under blown sand, and in volcanic ashes and under lavas. Formation of sediments by foraminiferæ, &c. in deep seas. Consolidation of strata by pressure, infiltrations, and precipitations, chemical decomposition and recomposition and heat.

11. *Central Heat, Volcanos, Earthquakes, and other Movements of the Earth's Crust.*—Theory of Coral Reefs. Fringing reefs, Barrier reefs, Atolls, and proofs of gradual subsidence of the sea bottom. Connexion of coral reefs with the volcanic islands of the Pacific Ocean and areas of partial upheaval. Upheaval of the west coast of South America. Oscillations of level on the coast of the Baltic, Greenland, &c. Raised beaches and sea bottoms.

Theories of central heat how inferred. Radiation of heat from the earth, consolidation and theory of the formation and shrinkage of its crust. External phenomena of volcanos, and theories of volcanic action. Earthquakes. Mallet's theory, and oscillations of level accompanying earthquakes.

Metamorphism of rocks. Theory of slaty cleavage, passage of shales,

claystate, sandstone, limestone, and their intermediate gradations into mica-schist, chlorite-schist, various kinds of gneissic rocks, quartz-rock, crystalline limestones, &c. Special development of distinct minerals in rocky masses. Relation of the above to gradual subsidence of rock masses and accumulation of strata above them. Origin of mountain chains. Disturbance and contortion of strata in successive stages, and probable causes of these phenomena.

B.—Classification of Animal and Vegetable Life.

12. All contained in *i* of the Elementary stage, p. 74, together with a general knowledge of the orders of Mammalia, Birds, Reptiles, Amphibia, Fish, Insects, &c., Crustacea, Echinodermata, Cephalopoda, Pteropoda, Pulmonata, Gasteropoda, Conchifera, Brachiopoda, Polyzoa, Corals, &c., and the classes and orders of the vegetable kingdom.

C.—Succession of Strata, Igneous Rocks, &c.

Palæozoic Series.

13. *Laurentian rocks* of Scotland, and Lower and Upper Laurentian rocks of Canada, &c. Huronian rocks of Canada. Their metamorphic character and peculiarities of structure. Eozoon Canadense, its nature, structure, and mode of growth. Ages of their metamorphism, and the inferences to be drawn from this.

14. *Cambrian and Silurian strata. Cambrian rocks* and their passage into the Lingula flag series. Fossils of the Cambrian rocks; their slaty cleavage and slate quarries.

Lower Silurian.

Lingula flags, their lithological character and fossils. *Tremadoc slates*, their lithological character and fossils. Unconformity of the Llandeilo and Bala beds on these, and break in the succession of life. *Llandeilo and Bala beds*, their lithological character and fossils. The igneous rocks, lavas, ashes, &c. associated with these.

Upper Silurian.

Llandovery or *Pentamerus beds*, their fossils and unconformity on the Lower Silurian strata, and partial change of species. Remainder of the *Upper Silurian strata* of the Wenlock and Ludlow series, their characters and fossils. First appearance of fish. Remains of plants. Reasonings on the connexion of unconformable stratification with partial or total breaks in the succession of species and genera in time. (This may be applied to all the cases of unconformity subsequently noticed.)

15. *Old Red Sandstone and Devonian strata.* Passage of *Upper Silurian* into *Lower Old Red Sandstone* in Wales and on its borders. Disappearance of the life of the Silurian period. The land that existed in Scandinavia and Britain before the deposition of the Old Red Sandstone, and round and on which the Old Red beds were deposited. Fish of the lower Old Red Sandstone; their distinctive characters. *Upper Old Red Sandstone.*—Lithological characters, fish, shells, and plants. Unconformity of the upper on the lower Old Red Sandstone, and approximate or actual passage of the former into the Lower Carboniferous strata. Condition of the waters in which the Old Red Sandstone formations were probably deposited. If partly glacial, and the signs of this? *Devonian strata.*—The division of these strata commonly made into Lower, Middle, and Upper Devonian. The marked difference of con-

ditions of deposit shown in the general nature of their fossils, viz., the fish of the Old Red Sandstone, and the Corals, marine bivalve and univalve shells, Cephalopoda and Trilobites of the Devonian strata. The stratigraphical relation of the Devonian strata to the Silurian rocks of Devon and Cornwall, of Germany, and North America. The relation of the so-called Upper Devonian beds to the Carboniferous strata. The appearance of new genera and species in the Devonian rocks. The plants of the North American beds.

16. *Carboniferous strata.*—Succession of Carboniferous strata in Wales, and its borders, and the south of England, viz., Lower limestone shale, Carboniferous limestone, Upper limestone shale, Millstone grit, and Coal-measures. The lithological characters of these and their fossils, marine, freshwater, and terrestrial. The manner in which the beds below the Coal-measures were accumulated. The manner of the formation of the Coal-measures, the peculiar strata beneath each (or most) beds of coal, the nature of the plants that formed the coal, their mode of growth, and the cause of the succession of beds of coal in thick series of strata. The gradual passage of the Carboniferous strata into a set of beds differently arranged in their stratification, especially in their lower members, proceeding northwards through Lancashire and Yorkshire into Northumberland, and Scotland. The physical causes that produced this difference. Also the absence of certain members of the series in some of the English, and in part of the Scotch coal fields and the physical phenomena that caused this absence. The Carboniferous series as developed in Ireland. The Carboniferous rocks of the continents of Europe and North America. Their resemblances to those of the British islands; climate, its average uniformity in space and time during this epoch. The surface areas occupied by the European Carboniferous strata now. The areas where they may be concealed under newer formations. The areas where originally formed, viz., which they spread over before reduced to their present limits by denudation. The disturbances of the Carboniferous rocks, and the reasons why coal fields (like parts of many other formations) so often lie in basins. Various kinds of coal, such as the varieties of coal commonly called bituminous, cannel coal, and anthracite. The chemical changes that vegetation underwent in its passage into coal, first on the surface, and afterwards under pressure. The passage of "bituminous" into anthracite coal and the probable reason, and the connexion of this subject with highly disturbed areas. Specialities. Development of crustacea of the Carboniferous rocks as distinguished from those of the Devonian and Silurian periods. Prevalence of certain genera of brachiopoda and conchifera, and relative proportions of these in the Carboniferous rocks when compared with older formations. Fish and reptiles of the Carboniferous rocks. Footprints, rain drops, land shells, and insects, and what they indicate. Ironstones. Mineral veins in Carboniferous limestone series.

17. *Permian formations.*—Succession of these in Britain, Germany, and Russia. 1st. The Rothliegende, its structure, and the evidences of the glacial agencies by which parts of it were deposited. 2nd. The Kuperscheifer of Germany and Marle-slate of England, with mineral contents, fish, &c. 3rd. The Magnesian limestone (Zechstein), its mineral character and composition; its fossils; evidence of their palæozoic character, partial community of species, and numbers and size when compared with the genera and species of the Carboniferous limestone. Cause of this. Unconformity on the Carboniferous and older rocks; submersion of old lands during its deposition; bearing of this on conglomeratic and brecciated structure of the Rothliegende,

and the general development of the life of the period, including plants and reptiles.

D.—Mesozoic or Secondary Series.

Lower Mesozoic.

18. *Divisions of Trias, or New Red Sandstone series* (see *p*, p. 75).—Unconformity and great break in succession of life in passing from Permian to New Red Sandstone. Great development of conchifera and decrease of genera of brachiopoda. The relation of this to lapse of time, as shown by unconformity, and continued prevalence in later times of many of these early Mesozoic types. The generally unfossiliferous character of the New Red Sandstone beds (Bunter), and their minor divisions in England. The absence in England of the Muschelkalk, and its presence on the Continent. Its fossils (see *p*, p. 75). The minor divisions of the New Red Marle (Keuper). Its fossil plants and reptile bones and footprints. Microlestes. Rain drops. The rock salt of this formation, and how it was deposited. Theory of inland salt lakes or seas of the the present day, and the bearing of this and of the above-named marks of rain drops and footprints on the point. New Red Sandstone of the United States, and numerous footprints of reptiles and impressions of bird-like feet. Gypsum. Those parts of the British islands that formed land before and during the New Red Sandstone period.

19. *Rhætic or Penarth Beds.*—Intermediate between New Red Marle and Lower Lias. Gradual passage of nearly unfossiliferous red marles into these more fossiliferous strata. Character and names of some of the common fossils, each as *Avicula contorta, Cardium Rhæticum*, &c. Their affinities with Liassic forms and conformable passage into that formation in Britain.

20. *Lias formations and Oolites.* (Jurassic of the Continent).—Names of the several formations of the Lias and Oolites between the Lower Lias and the Portland Oolite in serial order, and their grouping into Lower, Middle, and Upper Lias and Oolite. Lithological characters of the Liassic formations. Fossils of the different formations. Plants and insects. Corals, brachiopoda, conchifera, gasteropoda, cephalopoda, echinodermata, crustacea, fish, and reptiles. The distinctive characters of some of these, their relative numbers compared with the same classes in the Palæozoic rocks. Nature of the connexion of the Lias with the Inferior Oolite. Lithological characters of the Oolitic formations and their uses. Marine fossils of the different formations of the above-named classes; also mammalia. Evidences of the existence of older land in the neighbourhood of the Liassic and Oolitic seas, and of the climate of the period drawn from plants and animals. Names of the most characteristic genera of Lias and Oolites, especially with reference to their prevalence, such as the names of the prevalent genera of brachiopoda, conchifera, gasteropoda, and cephalopoda, echinodermata, crustacea, fish, and reptiles. Jurassic strata of the Continents of Europe and Asia. The Jura and the Alps, and the fossils of Solenhofen. Disturbance and metamorphism of Jurassic strata. Names of some of the species characteristic of some of the formations, and extent of the community of species. Contrast the life of these epochs with similar developments in Palæozoic epochs.

21. *Purbeck and Wealden strata.*—Their general fresh-water nature and marine interstratifications. Extent of these formations in England and on the Continent. Their characters and thickness. Fossils of the Purbeck strata. Plants, land-insects, mammalia, fish, reptiles, univalve and bivalve shells, and crustacea. Fossils of the Wealden formations as

above. Evidences of the upheaval of extensive continental land of the period, and the manner in which the Purbeck and Wealden beds were deposited.

Upper Mesozoic.

22. *Cretaceous series.*—Description of the British divisions and subdivisions. Their lithological characters and passage of Weald clay into Lower Cretaceous beds in the Wealden area and Isle of Wight. Fossils of the formations noticed in the same way as those of the Oolitic strata. The Chalk, by what organic bodies chiefly formed. Comparison with similar deposits forming in existing oceans. Nature of flints interstratified with chalk, and vein and tabular flints. Resemblances and differences of the genera and species of the Oolitic and Cretaceous epochs, and the bearings these have on lapse of time between the deposition of the Portland Oolite and the commencement of the Atherfield clay. Continental Cretaceous geology generally. Hippurite limestone. Upper Cretaceous rocks unknown in Britain. Maestricht beds and Chalk of Faxoe in Zeeland, Denmark. Upper Cretaceous beds and flora of Aix-la-Chapelle. Cretaceous strata of North and South America.

E.—Cainozoic or Tertiary.

23. *Eocene or Lower Tertiary.*—Meaning of the terms Eocene, Miocene, and Pliocene as used by Sir Charles Lyell. Grouping of greater divisions and subdivisions of the English and French strata as usually given in manuals. Areas occupied by the English and French Eocene strata. Evidence of the upheaval of the Chalk and older strata of Western Europe before the Eocene period. Fossils of the Thanet sand and Woolwich and Reading beds, of the London clay, Bagshot, Bracklesham, and Barton beds, and of the Isle of Wight and Hampshire strata from the Headon to the Hempstead beds inclusive; viz., plants, foraminifera, brachiopoda, conchifera, and gasteropoda, marine, estuarine, and fresh-water; cephalopoda, echinodermata, cirripedia, crustacea, fish, reptiles, birds, and mammalia. The evidence shown by these of the manner in which the different formations or parts of formations were deposited; 1st, into three broad divisions, estuarine and fluvio-marine below; marine in the middle; and fresh water, estuarine and fluvio-marine above. Evidences of land and its nature drawn from plants and from mammalian remains. Plants of the various subdivisions, and association of plants in Hempstead series with Eocene shells of lower beds. The nummulitic beds of England, the Continent of Europe, Asia, and Africa. Evidences of climates of Eocene times as indicated by shells, reptiles, and plants, &c. Original extension and subsequent denudation of Eocene beds in Britain. Denudation of the Weald.

24. *Miocene or Middle Tertiary strata.*—British Miocene strata and igneous rocks. Fossils of and nature of the strata. French marine and fresh-water and igneous rocks. Their fossils and the mammalia of the period. Miocene beds of the Rhine, Switzerland, Bohemia, and other parts of the Continent of Europe. Their divisions, lithological characters, and fossils. The Alps and other lands before the Miocene epoch, and the manner in which the Swiss, Italian, and other Miocene rocks were deposited. Theory of a glacial episode during Miocene times. Mammalia. The Miocene insects and flora, especially of the British, Swiss, Icelandic, and Arctic regions. Brown coal of England and the Continent. Disturbances of the Alps and Jura before and after the close of the Miocene epoch. Miocene rocks of India and the United States and their fossils.

25. *Post-Pliocene Strata, Cray, &c.*—(See *w*, p. 3) and in addition proofs of Britain having been joined to the Continent before the Crag epoch.

26. *Glacial period and other Strata later than the Crag.*—Old land surface of Britain later than the Crag and Forest beds. Their plants, mammalia, and shells. The Glacial period. Great glaciers before the deposition of the boulder drift in the northern and southern hemispheres generally, and in Switzerland and other mountain ranges specially. The signs of this. Boulder beds and arctic shells. Minor glaciers during and after the deposition of the boulder beds. Their signs. Erosion of valleys by ancient glaciers. Theory of the formation of rock-bound basins by glaciers and of other lakes by boulder beds and eskers or kaims. General nature of the fauna of the period. Union of the British islands and their union with the continent before and after the glacial epoch. Theories of the causes that produce this glacial period and of glacial periods in general. Volcanic rocks of the Eifel. Loess of the Rhine and other rivers, brick-earths, river-gravels, and alluvia of various ages. Mammalian and other bones in these in Europe, Asia, and America. Bone caves and the manner of the preservation of their fossils. Relics of man and his works in caves, river deposits, shell mounds of Denmark, &c., and in Swiss and other lakes. Contours of ground before and after the glacial period. Pre-glacial and post-glacial valleys.

27. Theories that have been proposed to explain the distribution of life in individual formations and throughout the whole geological series, or the origin, increase, distribution, and disappearance of species and genera commonly so called. The relations of the life of successive formations to each other generally. Relations of existing faunas and floras of the world to those of Miocene, Pliocence, and Post-pliocene age.

28. Water-bearing strata and underground drainage. Artesian and other wells. Rocks in which ores are found, and mode of occurrence of those in beds, lodes, and superficial detritus. The rules that ought to guide the miner in sinking for coal and other minerals, when the beds in which they lie are concealed by overlying and unconformable strata.

Examination for Honours.

In additio n to the foregoing, candidates may be examined in any subjects treated of in standard manuals and other books mentioned below.

Text-books.—Geology: Lyell's *Principles of Geology*; Lyell's *Elements of Geology; The Students Manual of Geology*, Jukes; Jukes's *Geology for Schools;* Page's *Introductory Text-book;* Page's *Advanced Text-book;* Ramsay's *Physical Geology and Geography of Great Britain;* Jukes's *Popular Physical Geology;* Dana's *Manual of Geology;* Dana's *Text-book of Geology;* Page's *Handbook of Geological Terms;* Woodward's *Recent and Fossil Genera of Shells;* Bristow's *Glossary of Mineralogy.*

Other books that may be consulted: Murchison's *Siluria;* De la Beche's *Researches in Theoretical Geology;* De la Beche's *Theoretical Observer;* Darwin's *Journal of a Naturalist;* Darwin's *Origin of Species;* Morris's *Catalogue of British Fossils;* Lowry's *Tabular View of Characteristic British Fossils;* Lowry's *Chart of the Characteristic British Tertiary Fossils;* *Chart of Fossil Crustacea*, Salter and Woodward.

Subject XIII.—Mineralogy.

Elementary Course.

A. Instruction in this subject should commence with a distinct understanding of the characters and circumstances by which minerals, properly so called, are to be distinguished from other inorganic substances, and of the position of this science in relation to the collateral sciences of physics, chemistry, and geology. Definitions of a mineral, a crystal, and of the conditions termed crystalline and amorphous. Occurrence of other more or less regular forms not crystals. Distinction of compound masses or mixtures of minerals.

B. *Crystallography*, as the essential means of appreciating the forms naturally assumed, under favourable conditions, by almost all inorganic bodies of definite composition, must commence with the needful definitions; faces, edges, and solid angles; plane figures of 3, 4, 5, 6 and 8 sides; the names and chief features of the more important geometrical solid figures which occur among crystals; the object of referring the faces to systems of axes, and the various directions in which these may be placed.

Method of drawing crystals isometrically.

Relation of the hemihedral to holohedral forms.

The grounds for grouping the various crystal forms into six systems.

Laws by which the derivation of one form from another within the limits of the same system is determined.

Complex or modified crystals may be regarded as combinations of the faces of two or more simple forms.

The leading figures of the six systems to be studied, with frequent practice in drawing.

Twin crystals and hemitropes; the relative position of the axes of their several portions.

Irregularities to which the surface of crystal faces is subject, certain angular elements remaining constant; measurement of these latter by instruments. Principles of the contact goniometer and of Wollaston's goniometer.

C. *Aggregation*, or natural grouping of—1stly, the distinctly crystallized minerals; 2ndly, of the crystalline minerals, especially with reference to structure and general form of masses of the useful minerals and of crystalline rocks.

D. *Other physical properties.*—The cleavage of crystallized substances, and its relation to crystalline form. Fracture, its various characters. Comparative hardness, how best determined. Different qualities of tenacity. Specific gravity of solids, how determined; the balance, the areometer.

Property of magnetism; what substances are capable of being attracted by a magnet, and what is the comparative intensity of the effect. Polarity. Influence of certain minerals disseminated in rocks on the correctness of surveys.

Peculiarities of smell and of taste which distinguish a limited number of minerals.

E. *Optical characters.*—Single and double refraction, and their relation to certain crystallographical systems.

Different degrees of lustre and transparency.

Colour essential in some species, not so in others; varieties of colour, how far they are capable of definition.

Phosphorescence as produced by different methods and exhibited by certain minerals.

F. *Chemical characters.*—Simple or elementary substances; some of them occur as minerals; their symbols and the derivation of the same. Equivalents; chemical combinations; principal groups of these occurring in the mineral kingdom.

Dimorphism of particular substances, accompanied by a difference in other physical characters besides form.

The employment of acids in the discrimination of minerals.

The blowpipe, its form and uses; the reducing and the oxidizing flames. Trial of comparative fusibility, of the colour given to the flame, the incrustation on charcoal; the effects of fusing various metallic oxides with beads of borax glass.

Pseudomorphism.—The phenomena presented by minerals which have the composition of one mineral coupled with the form of another. Analogous action of fossilization or petrifaction.

G. General requirements of a system of classification of minerals.

H. The physiography or systematic description of minerals. This last division should include all the more remarkable varieties as well as species, and should take especial note of the modes and places of occurrence, as well as of the association of particular groups of minerals in certain veins or formations.

It would not be expected that the elementary course should include the description of the rarer substances, or of those species whose characters are not yet well ascertained, but attention should chiefly be given to those species which form the constituents of rocks and those which as ores supply the materials for the production of the useful metals.

Advanced Stage.

A. Discussion of the relation of true minerals to other inorganic substances, and how far bodies of organic origin may be classed among minerals.

B. The dependence of symmetry in crystal forms on the axial system. The crystallographical value of a face is the same as that of any plane parallel to it, on the same side of the centre of the crystal. Position of the normals to a face. The methods of indicating the faces, and thence the entire forms of crystals by symbols. Drawing of a sphere of projection in which the poles of the crystal faces may be shown. Convenience of representing in a great circle the poles of a zone of faces. The magnitude of the angle between the normals being the supplement of the mutual inclination of the planes, the first kind of measurement (*i.e.* between the normals) is adopted by certain authors, and is easily reducible into the other kind. Statement of the angular and linear dimensions requiring to be determined for the description of the simple forms of all the systems after the cubical.

Twin crystals, the twin plane, and twin axes; examples of their position in important minerals of the several systems.

C. Reticulated, wiry, and capillary forms, explanations suggested for their formation. Other peculiarities in grouping.

D. The prevailing directions of cleavage in the several crystallographical systems.

Determination of the specific gravity of a substance contained in a mechanical mixture.

Electricity; by what means this property is exhibited in different minerals.

E. Refraction of light; different positions of the ordinary and extraordinary ray in doubly-refracting bodies. Optic axes of a crystal, their variation in different species of minerals.

Polarized light, its connexion with double refraction. Construction of the polariscope.

Dichroism and pleochroism, a remarkable property of some few minerals.

F. Character of the chemical composition of the more complex minerals.

The electro-negative element in chemical combinations has the preponderating effect in influencing the external character.

Isomorphism, as shown by Mitscherlich, to result from a group of—1st, isomorphous acids; 2nd, of isomorphous bases. Polymeric isomorphism of Scheerer; its meaning, and the arguments in its favour. Vicarious or irregular replacement among one another of isomorphous constituents.

Testing of minerals in the moist way simply practicable for qualitative purposes.

Treatment of various metallic ores before the blow-pipes.

Pseudomorphous substances as arranged in groups according to the nature and degree of change they have undergone.

Discussion of anogenic and katogenic pseudomorphs, or those which have been produced above by oxidizing, and below by reducing processes respectively.

Extension of pseudomorphous action on a large scale to "gossans" and to geological formations.

G. Methods of classification as proposed by the leading authors in mineralogy. Review of the difficulties caused in classification by the occurrence of the isomorphous substances.

Discussion of the means of defining a species among minerals.

H. Species and varieties of minerals as described in the best manuals. Their occurrence under various circumstances to be particularly studied. The changes in composition wrought by nature (pseudomorphous action), by which one species is converted into another, and the essential points of difference between species much alike in certain characters, will be held of much importance in dealing with the minerals of special value or interest. It is not expected that the memory should be charged with the details of substances of very rare occurrence, or of doubtful independence as species.

Examination for Honours.

The questions will as a general rule be such as are embraced in the above syllabus, but candidates will be required to prove a practical acquaintance with minerals and with crystal forms, and will need to have studied some of the more advanced works mentioned below.

As text-books may be recommended—

Professor Ansted's *Elementary Course of Mineralogy and Geology*, London, 1856.

Nicol's *Elements of Mineralogy*. Edinburgh, 1858.

Dana's *Manual of Mineralogy*. 1851.

Bristow's *Dictionary of Minerals*. Longman & Co. 1861.

For more advanced students—

Brooke and Miller's *Mineralogy*. London, Longman, 1852.

On Crystallography. Rev. W. Mitchell, in Orr's "*Circle of the Sciences.*" London, 1856.

Dana's *System of Mineralogy*. 5th edition. New York, 1868.

Naumann's *Elemente der Mineralogie*. 7th edition. Leipzig, 1868. Williams and Norgate, London.

Breithaupt's *Paragenesis der Mineralien*. Freiberg, 1849.

Haidinger's *Handbuch der Mineralogie*. Vienna, 1845.

Des Cloizeaux, *Manuel de Mineralogie*. Paris, 1862.

Greg and Lettsom's *Manual of British Minerals*. 1858.

When it is intended to teach this subject with special reference to the practical working of minerals, the physiographical part will be occupied more particularly with certain of the useful species and their associated substances, and the following works may be consulted:—

W. J. Henwood *on the Metalliferous Deposits of Cornwall and Devon*, 1843.

Bischof, *Chemical and Physical Geology, translated by the Cavendish Society*. 1854.

Subject XIV.—Animal Physiology.

First Stage or Elementary Course.

Questions will be confined to the under-mentioned topics.

A. Anatomical Preliminaries.

The general build of the human body.

The meaning of the terms skull, vertebra, rib, sternum; scapula, clavicle, humerus, radius, ulna, carpus, metacarpus, phalanges (of the hand); pelvis, femur, tibia, fibula, tarsus, metatarsus, phalanges (of the foot); integument, mucous membrane, connective tissue, tendon, ligament, cartilage, muscle, nerve.

The position in the body and the general form and size of the following internal parts:—The brain and spinal cord; the pharynx, the gullet, stomach, and intestines; the salivary glands, the liver and pancreas; the posterior nares, the larynx, trachea, and lungs; the kidneys and bladder; the heart and the great vessels; the thoracic duct, and the chief lymphatic glands; the spleen; the diaphragm.

B. Chemical Preliminaries.

The composition of air, water, carbonic acid, and ammonia.

The chemical elements of which protein, fat, and sugar are composed.

The nature of the most important mineral compounds which are formed in the body.

The ultimate chemical products of the decay and putrefaction of the dead body.

C. General View of the Animal Body in Action.

The evidence that the body constantly wastes during life; the nature of the waste products, and of the compensation for waste; the essential characters of food stuffs.

The part played by oxygen in the economy.

The number, position, and uses of the sensory organs.

The nature of cilia and the movements to which they give rise.

The physiological properties of muscular tissue.
The modes in which muscles give rise to movements and sustain the body in the erect posture.
The physiological properties of nervous tissue.
The general functions of the brain and of the spinal cord.
Local and general death.

D. Special Physiology.

a. The circulatory Organs.

The arrangement of the chambers of the heart and of its valves.
The general differences between arteries, veins, and capillaries.
The course of the circulation of the blood and the reasons why the blood moves only in one direction.
The meaning of the beat of the heart, of the pulse in the arteries, and of the jet-like flow of blood from a cut artery.
The evidence of the circulation obtainable in the living body.

b. The Blood.

The phenomena presented by blood drawn from the body.
The general nature of the corpuscles of the blood.
The general composition of the blood.
The difference between blood and lymph.

c. Respiration and other processes which modify the condition of the Blood.

The obvious differences between arterial blood and venous blood.
How venous can be converted into arterial blood out of the body.
How and where venous is converted into arterial blood in the body.

How the air which leaves the lungs differs from that which enters them.
The general nature of the respiratory movements.
The course of the air, when breathing takes place through the nose.
The conditions which give rise to asphyxia.

The essential composition of the urine.
The general structure of the apparatus by which its separation from the blood is effected.

The essential composition of the sweat.
The general structure and functions of the skin.

The manner in which the blood enters and leaves the liver.
The products yielded by the liver to the blood directly, and through the medium of the alimentary canal.
The chief characters of the bile. The use of the gall-bladder.

The source of the heat of the body. The manner in which the temperature of the body is distributed and regulated.

d. Alimentation.

The quantity of dry solid and gaseous aliments required daily by an adult man.
The classification of food stuffs.
The economy of a mixed diet.
What becomes of proteid, fatty, amyloid, and mineral food stuffs respectively.

The nature and functions of the salivary, gastric, and pancreatic secretions.

The manner in which nutritive matters are absorbed, and innutritious matters excreted, from the alimentary canal.

e. Animal Mechanics.

The different kinds of levers and their exemplifications in the body.

The nature of joints, with examples of ball and socket, hinge and pivot-joints.

The conditions of the production of the voice.

The difference between voice and speech.

f. The Senses and their Organs.

The general structure of the organ of touch.

The means of measuring the acuteness of the sense of touch in different parts of the body.

The general structure of the organs of taste and of smell.

The external auditory passage and the tympanic membrane.

The tympanum and how it opens into the pharynx.

The chain of ear bones and their connection on the one hand with the tympanic membrane, and on the other with the membrane of the fenestra ovalis.

The form of the membranous labyrinth and of the cochlea. The nature of the endolymph and perilymph and of the otoconia. The relation of the auditory nerve to the labyrinth.

The manner in which the impact of sound-waves on the tympanic membrane affects the auditory nerve.

The eyelids, and the manner in which they are moved. The lachrymal apparatus. The form of the eye ball; its general structure, and the functions of its component parts.

The manner in which the movements of the eye-ball are effected.

The blind spot. The duration of luminous impressions. Colour-blindness.

g. The Nervous System.

The difference between the cerebro spinal and the sympathetic systems.

The nature and functions of the roots of the spinal nerves.

The evidence that the spinal cord is capable of effecting reflex action.

The nature and functions of vaso-motor nerves.

The most important functional peculiarities of the medulla oblongata.

The evidence that the higher faculties of the mind have their seat in the brain.

The number, names, and functions of the cerebral nerves.

Second Stage of Advanced Course.

In addition to the preceding, a knowledge of the following subjects will be required :—

a. The Circulatory System.

The minute structure of the organs of circulation. The manner in which they are supplied with blood and with nervous energy. The pericardium.

The detailed analysis of the movements and sounds of the heart, and of the phenomena of the pulse. The causes of blushing and of pallor. The influence of the respiratory movements on the circulation. The effect of irritation of the pneumogastric nerve upon the heart's action.

The structure of the lymphatic vessels and glands, and the connexion of the lymphatic with the blood vascular system.

b. The Blood, the Lymph, and the Chyle.

The sizes and the structure of the corpuscles of these fluids. The phenomena which they exhibit. Their probable functions. The composition of the blood in detail. The nature of the process of coagulation.

c. The Respiratory System.

The structure of the thorax. The pleuræ. The structure of the respiratory organs and the distribution of the blood through them. The analysis of the respiratory movements in detail. The mechanism by which coughing, sneezing, sighing, and hiccoughing are effected. The physical and chemical processes involved in the conversion of inspired into expired air, and of venous into arterial blood. The quantity of waste products excreted and of oxygen taken in by the lungs in 24 hours. The rationale of ventilation.

The Urinary System.

The minute structure of the kidney, ureter, and bladder.

The circulation in the kidney and the changes which the blood undergoes in passing through it.

The quantity of waste products of all kinds excreted by the kidneys in 24 hours.

The Skin.

The minute structure of the skin, of the hairs, nails, and glands connected with it. The muscles of the hair-sacs.

The quantity of waste products excreted by the skin in 24 hours.

The Liver.

The structure of the liver, and the course of the blood through it. The arrangement of the ducts of the liver. The composition of the bile, and the quantity of that fluid secreted daily. The functions of the bile. The nature and uses of glycogen.

The Spleen and the other Ductless Glands.

The structure and probable functions of these organs.

The Alimentary Canal.

The structure, forms, kinds, and succession of the teeth. The structure and functions of the salivary glands. The structure and functions of the tongue, the soft palate, uvula and tonsils. The pharynx and the œsophagus and the structure of their walls. The stomach, its form; the structure of its walls; its glands and their functions. The divisions of the intestine. The structure of its walls. Villi. Glands. Peyer's patches. The structure and functions of the pancreas. The peritoneum and the nature of the mesentery.

The details of the digestive and absorptive processes. The profits and losses of the economy, and how they are balanced during health.

The Muscular System and Animal Mechanics.

The minute structure of fibrous, cartilaginous, bony, and muscular tissue.

The physical, chemical, and physiological properties of muscle. Rigor mortis. The mechanism of standing, walking, running, and jumping.

The structure and working of the larynx. The mode in which consonantal and vowel sounds and articulate speech are produced.

The Senses.

The structure of the papillæ of the skin, and of the tactile corpuscles.

The muscular sense.

The minute structure and nervous supply of the tongue as a sensory organ.

The structure of the olfactory organ. The nature and extent of the air chambers connected with it. The minute structure of the Schneiderian membrane and of the olfactory nerve-fibres. The mechanism of smelling.

The structure of the ear. The external ear and the muscles which move it. The muscles connected with the ear bones and their actions.

The minute structure of the membranous labyrinth and cochlea. The probable functions of these organs.

The minute structure and the properties of the various constituents and coverings of the eyeball. Complementary colours. Phosphenes. Purkinje's figures. Adjustment. Regulation of light. Double vision with one eye.

Sensations and Judgments.

The notion of roundness. Subjective sensations. Ventriloquism. Erect vision. Double vision and single vision with two eyes. Judgments of distance and form. The pseudoscope and the stereoscope.

The Nervous System.

The structure of ganglionic corpuscles and of nerve fibres.

The structure of the investments of the brain and spinal cord.

The minute structure of the spinal cord. The general disposition of the histological elements of the brain.

The names and positions of the larger divisions of the brain and of its ventricles.

The origins and functions of the spinal and cerebral nerves in detail.

The effect of cutting the spinal cord in various ways, and of injuries to the medulla oblongata.

The effect of removing the hemispheres of the brain.

Unconscious cerebration and acquired reflex action.

Reproduction.

The structure of the ovum and of the spermatozoon.

The process of yelk division.

The formation of the blastoderm and the development therefrom of the body of the embryo, with Amnion, Allantois, and Yelk sac.

The nature of the Chorion, of the Decidua, and of the Placenta.

The mode in which the fœtus is nourished.

The development of the heart and the fœtal circulation. The changes in the circulation which take place at birth.

The lacteal glands and lactation.

The modifications in the proportions of the body from birth to adult age.

The general modifications in the condition of the skeleton from its earliest appearance. The notochord. The process of ossification.

The thymus and thyroid glands.

The two dentitions.

Examination for Honours.

Candidates will be examined in any subject treated of in the standard English works upon Physiology, such as Carpenter's *Principles of Human Physiology*, and Marshall's *Outlines of Human and Comparative Physiology*.

For the elementary stage—

Lessons in Elementary Physiology, by T. H. Huxley, 18mo., 4*s*. 6*d*.
(London, Macmillan, 1868.)

is recommended as a text book.

For the advanced stage, in addition to the above, the following works are recommended:—

A Manual of Physiology, by W. B. Carpenter, 12mo., 12*s*. 6*d*.
(London, Churchill, 4th ed., 1865.)

Handbook of Physiology, by W. S. Kirkes, 8vo., 12*s*. 6*d*.
(London, Walton and Maberly.)

Subject XV.—Zoology.

N.B.—Students should have been instructed in the elements of physiology before commencing the study of Zoology. After May 1869 no candidate will be passed in Zoology unless at the same, or at a previous, examination he has been passed in the elementary stage of animal physiology.

I.—First Stage or Elementary Course.

Questions will be confined to the following topics:—

The characteristic and distinctive features of the following groups of animals:—*Vertebrata, Mammalia, Aves, Reptilia, Amphibia, Pisces, Arthropoda, Insecta, Myriapoda, Arachnida, Crustacea, Annelida, Echinodermata, Rotifera, Infusoria, Spongida, Foraminifera, Cœlenterata, Hydrozoa, Actinozoa, Polyzoa, Brachiopoda, Lamellibranchiata, Pulmogasteropoda, Branchio-gasteropoda, Cephalopoda.*

(Candidates will be expected to be able to refer any British member of one of these groups to its proper group.)

The general nature and arrangement of the skeleton (or hard parts) in *Foraminifera, Spongida, Hydrozoa, Actinozoa, Brachiopoda, Lamellibranchiata, Gasteropoda, Echinodermata, Arthropoda, Vertebrata.*

The general nature and working of the alimentary apparatus observed in *Infusoria, Hydrozoa, Actinozoa, Polyzoa, Gasteropoda, Annelida, Arthropoda, Pisces, Aves, Mammalia.*

The general structure and working of the organs of circulation and respiration in *Lamellibranchiata, Gasteropoda, Crustacea, Arachnida, Insecta, Pisces, Amphibia, Reptilia, Aves, Mammalia.*

The general nature of the nervous system in *Rotifera, Echinodermata, Annelida, Arthropoda, Polyzoa, Lamellibranchiata, Vertebrata.*

The principal characters of the organs of hearing in *Lamellibranchiata, Crustacea, Pisces,* and *Mammalia;* and of the organ of sight in *Annelida, Arachnida, Insecta, Gasteropoda,* and *Vertebrata.*

The general nature of the process of development in *Hydrozoa, Lamellibranchiata, Crustacea, Insecta, Amphibia,* and *Aves.*

II.—Second Stage or Advanced Course.

Questions may be set in all subjects enumerated under the Elementary Stage, and in addition on the following topics:—

The characters and distinctive peculiarities of the *Nematoidea, Acanthocephala, Turbellaria, Trematoda, Ascidioida* (or *Tunicata*), *Pteropoda, Radiolaria* (or *Polycistina*), *Gregarinida, Rhizopoda;* and of the principal subdivisions (orders) of the *Mammalia, Aves, Reptilia, Amphibia, Pisces, Insecta, Arachnida, Crustacea, Annelida, Echinodermata, Hydrozoa, Actinozoa, Brachiopoda, Lamellibranchiata, Gasteropoda, Cephalopoda.*

Reference of any specimen to its proper class and order.

The most important modifications of the vertebrate skeleton observable in *Pharyngobranchii, Marsipobranchii, Elasmobranchii, Teleostei, Chelonia, Ophidia, Aves, Monotremata, Marsupialia, Cetacea, Cheiroptera, Ungulata, Simiadæ, Man.*

The leading modifications of the appendages of the body and head in the *Arthropoda.*

The structure of the test in *Echinus, Uraster,* and *Comatula* (*Antedon*).

The structure and nomenclature of the parts of the shell in *Brachiopoda, Lamellibranchiata, Gasteropoda,* and *Cephalopoda.*

The structure of the corallum in the *Actinozoa.*

The structure, succession, and chief forms of the teeth in *Mammalia.* The dental formulæ of Man, of old and new world apes; of the hedgehog, the dog, the cat, the horse, the ox, the pig, the rabbit, and the rat.

The structure and mode of formation of "whalebone."

The structure and movements of the beaks of *Aves* and *Chelonia.*

The poison fangs of snakes and the mechanism by which they are moved.

The teeth of ordinary fishes, of sharks, rays, *Chimeræ,* and lampreys.

The alimentary apparatus of the *Ruminantia,* and the mode in which it works.

The leading forms assumed by the circulatory, respiratory, renal, hepatic, and salivary organs in the animal series.

The modifications of the brain and of the sensory organs in the *Vertebata, Arthropoda, Cephalopoda* and *Gasteropoda.*

The leading forms of the reproductive apparatus, with the general process of development, in *Mammalia, Aves, Reptilia, Amphibia, Pisces Arthropoda, Annelida, Echinodermata, Trematoda, Tæniada, Spongida Cælenterata, Lamellibranchiata, Pulmo-gasteropoda, Branchio-gasteropoda Cephalopoda.*

The distribution of animals. The principal forms of animal life characteristic of Australia; of South America, with Mexico; of Africa, south of the Sahara; of Hindostan; of Central Asia, with Europe and North Africa; of America, north of Mexico; of the Atlantic, the Indo-Pacific, the Arctic and Antarctic Oceans.

The broad facts relating to the succession of animal life upon the globe.

The natural history of the animals which supply articles of commerce.

III.—Examination for Honours.

Questions at the discretion of the Examiner, who will have regard to the state of Zoological teaching in the country and the means of acquiring information.

Subject XVI.—Vegetable Anatomy and Physiology.

I. First Stage or Elementary Course.

Distinctions between flowering and flowerless plants. Growth of flowering plant from seed. Plumule, radicle, cotyledons.

Ascending and descending axis: axial and appendicular organs.

Cells: Parenchyma, prosenchyma, ducts, spiral vessels. Vascular bundles.

Structure and growth of root. Spongioles.

Structure of exogenous stem. Pith, wood, bark, medullary rays.

Epidermis. Hairs, prickles.

Nature, position, and development of leaf buds: branches and spines.

Venation and structure of leaves. Stomates.

Floral organs, protective and essential. Sexes of plants.

Structure and dehiscence of anthers. Structure of pollen grain. Evolution and course of pollen tube.

Stigma. Ovule: nucleus and coats, foramen. Anatropous campylotropous and orthotropous ovules. Impregnation. Embryo sac.

Seed: hilum, chalaza, rhaphe. Albumen. Embryo: monocotyledonous and dicotyledonous.

Food of plants. Course of sap, osmose, exhalation, respiration (by day and night), assimilation. Cambium layer.

Composition of cellulose, starch, sugar, gum, gluten, chlorophyll.

In the earlier course these subjects should be taught quite generally, as they occur in the ordinary type of structure. All exceptions should be reserved for the higher course.

Second Stage or Advanced Course.

Cell development by division and free cell formation. Protoplasm. Formation of ducts and vessels.

Cell contents. Cytoblast or nucleus, secondary deposits, air, crystals, rhaphides, chlorophyll, oil.

Circulation of fluids in cells.

Functions of cells and vessels. Intercellular spaces, latex canals.

Structure of trunk of climbing plants, and of tree ferns.

Parasitical plants; leafy and leafless, on root, stem, bark.

Development of leaves.

Abnormal forms of stomates.

Pollen formation.

Ovule of Loranthaceæ.

Impregnation and embryogeny of Conifers and their allies.

Reproduction of Cryptogams.

Propagation of plants otherwise than by seed.

Physiology of flower; absorption of oxygen, evolution of heat.

Irritability of leaves, tendrils, stamens.

Theory of manures.

Differences between animals and plants.

Examination for Honours.

Questions at the discretion of the examiner, who will have regard to the state of learning in the country and the means of acquiring information.

Subject XVII.—Systematic and Economic Botany.

First Stage or Elementary Course.

A.—*Morphology*.

Ascending and descending axis.

Root: annual, biennial, perennial; fibrous, tuberous, tap, &c.

Stem: woody or herbaceous; erect or creeping; corm, bulb, rhizome.

Leaf: entire or variously cut; simple or compound; kinds of composition. Petiole, blade.

Stipules.

Tendrils.

Bracts.

Inflorescence: raceme, spike, catkin, umbel, capitulum, corymb, panicle.

Flower: complete or incomplete, uni- or bi-sexual; regular or irregular.

Calyx and corolla: poly- or gamo- sepalous or petalous; persistent or deciduous; valvate, imbricated or twisted in estivation.

Stamens: number and relative position; insertion, cohesion. Filament, anther.

Ovary: adherent or free; of one or more carpels, uni- or multi- locular; number and cohesion of styles.

Ovules: solitary or numerous; erect, horizontal, or pendulous; with axile, free central or parietal placentation.

Fruit: dehiscent or indehiscent; succulent or dry; drupe, berry, achene, capsule, legume, pod.

B.—*Classification.*

Dicotyledones: thalalamifloræ, calycifloræ, corollifloræ, incompletæ.

Monocotyledones.

Acotyledones: acrogens, thallogens.

Distinctive characters of the largest British natural orders, viz.:—

Ranunculaceæ.	Scrophulariace.
Cruciferæ.	Labiatæ.
Caryophylleæ.	Orchideæ.
Leguminosæ.	Liliaceæ.
Rosaceæ.	Cyperaceæ.
Umbelliferæ.	Gramineæ.
Compositæ.	

C.—*Economic Botany.*

The candidate will be expected to know the economic plants indigenous to Great Britain and Ireland, as well as those contained in the following list:—

Wheat.	Gutta Percha.	Opium.
Barley.	Turpentine.	Quinine.
Oats.	Palm oil.	Jalap.
Rye.	Cocoanut oil.	Ipecacuanha.
Rice.	Castor oil.	Aloes.
Indian corn.	Olive oil.	Rhubarb.
Pea.	Indigo.	Senna.
Bean.	Logwood.	
French bean.	Madder.	Nutmeg.
Pasture Grasses.	Catechu.	Cloves.
Clover.	Galls.	Pepper.
Turnip.	Oak bark.	
Mangold.	Cotton.	
Hops.	Flax.	
Tea.	Hemp.	
Coffee.	Jute.	Orange.
Cocoa.		Vine.
Chicory.	Mahogany.	Almond.
Tobacco.	Oak.	Peach.
Starch.	Deal.	Plum.
Sugar.	Teak.	Melon.
Gum.	Maple.	Cucumber.
Caoutchouc.	Walnut.	Gourd.

The use of the product, the part of the plant affording it, the name and natural order of the plant which yields it, its native country when wild, and when cultivated the area of cultivation will be expected to be known.

SECOND STAGE OR ADVANCED COURSE.

Modifications of stem structure (as in cactus, &c.)
Modifications of leaf structure: Phyllodes, pitchers.
Morphology of cryptogams: frond, thallus, theca or spore-case, sorus elater, mycelium, spore, &c.
Phyllotaxis.
Theory of Inflorescence.
Metamorphosis of flowers.
Dimorphism of flowers.
Principles of classification.
Natural family or order, genus, species, variety.
Variations of cultivated plants.
Characters of all British natural orders, and of the largest and most important exotic orders.
Classification of Cryptogams: characters of ferns, Lycopodiaceæ, Equisetaceæ, mosses, Hepaticæ, Characeæ, Algae, Lichens, Fungi.
Principal economic plants belonging to each natural order.
General principles of geographical botany.

EXAMINATION FOR HONOURS.

Questions at the discretion of the examiner, who will have regard to the state of botanical learning in the country and the means of acquiring information.

Subject XVIII.—Principles of Mining.

The Art of Mining embraces so wide a field of study that equal practical proficiency in its various branches is not to be expected from persons engaged in different classes of mines, nor equal knowledge of its general features from students brought up in districts where only one or another branch of the subject is practised. The examination papers will therefore contain a sufficient variety of questions to suit candidates belonging to either a metalliferous or a coal district.

The subject at large being properly an art, or application of various branches of science, and one in which every question will admit of various degrees of proficiency being shown in the replies, the higher numbers will be awarded only to those answers which exhibit the greater amount of completeness and accuracy. Curt and vague answers will be but of little value, and exactness will be expected in all that relates to numbers, prices, weights, and measures.

Those who wish to gain a general knowledge of the topics for examination may be recommended to direct their attention to the subjoined heads, viz.:—

I.—FOR THE FIRST STAGE OR ELEMENTARY COURSE.

1. Geology and Mineralogy, more particularly those portions of the sciences which bear on the following subjects,—the nature and position in the earth's crust of the useful minerals, the classes of rock with which they are severally associated, the special character of heaves, throws, troubles, and all kinds of dislocation; the particular differences between beds and lodes, and their minerals, and the chief features of irregular repositories.

2. The methods of prospecting and searching at surface for ores and other minerals.
3. Breaking rock by manual labour alone; various forms of pick, and of hammer and wedge employed for the purpose. Use of gunpowder and other explosives; precautions to be observed in boring and in firing shots.
4. Depths attained by mines and bore holes in various cases. Geographical distribution of the chief mining districts.
5. Ventilation of mines, why important. Composition of air, carbonic acid gas, and fire-damp; how the latter noxious damps occur, and what precautions against them should be adopted, either for a temporary purpose or permanently. Reasons of a natural circulation of air to some extent being observable in all mines. Various applications of water to aid ventilation. Means of applying heat, or machines for the same purpose.
6. Lighting of workings; principle and construction of the safety lamp.
7. Circumstances under which water enters mines. Working of ordinary pumps; special requirements of pumps for mines. Mode of applying human or horse labour to the winding of water and stuff or mineral; fixing and comparison of the unit of work. Water wheels and steam engines, variety and construction of, as in use for mining purposes.

   Carriage or conveyance along levels and inclines; barrows, tramplates, rails, tubs, or wagons.

   General features of winding in shafts by machinery.
8. The form and dimensions of shafts applied to various purposes; sinking, and precautions against accident from falls and from collapse of sides.
9. Driving of levels, drifts, and wind-roads; their rate of inclination, breadth, and height in various districts; methods and cost of arching them, and of timbering or wooding.
10. The removal or *exploitation* of mineral after completion, to a certain point, of dead work; stopes and pitches, under various circumstances. Pillar-working at various depths, and other forms of extracting coal or ironstone. Main considerations of safety and economy which have to be studied in adopting a particular plan.
11. Means of security to be adopted in shafts; 1st, as to construction and fixing of ladders; 2nd, as to rules and arrangements where the men ride instead of climbing.

II.—For the Second Stage or Advanced Course.

1. Details as to the form in which the useful minerals are accumulated; stratified deposits; alluvial or stream-works; lodes and their various directions; pipes and other irregular repositories. Examples of remarkable localities; true sectional drawings or profiles to be studied. Examples of heaves, and alleged laws according to which they have taken place. Composition and physical state of the containing rock or "country."
2. Exploring, shoading, and costeaning. Grounds for opinion in the re-opening of old mines; preliminary operations in virgin districts.
3. Breaking of ground; the various implements employed, their form, dimensions, and weight; boring for shots; the various modes of firing charges. Heavy charges, how calculated and fired; rules for ensuring safety. Drilling and coal-cutting machines.
4. Deep boring, under what circumstances applicable,—apparatus for; description of varieties in use; lining of bore-holes.

5. Management and supervision; payment of men employed at mines, at surface and underground, varying in principle with the different classes of operation; reasons for tut-work or piece-work, and tribute or bing-tale under different circumstances. Calculations for cost of driving, sinking, tramming, &c.
6. Physical principles of ventilation; practice of mines where simple natural ventilation is employed; ventilation of large areas and of deep or complicated workings by guiding the natural current; artificial means, and their details, for promoting ventilation. Precautions to be taken under specially dangerous conditions.
7. Illumination, of various kinds, their economy; safety lamps in all their best modifications; circumstances under which they should be employed; precautions in their use.
8. Mechanical division of the subject. Strength of materials used in mines; human and horse power, principles and construction of machines to which they are applied. Hydraulic machines; construction of the water-wheels, turbines, and pressure engines most suitable to the various operations of mining. Steam engines, for pumping and for winding; arrangement and construction of the varieties most in use. Form and dimensions of boilers. Pumps employed in mines, mode of placing them; construction of the lifts; materials and details of the rods, set-offs, counterbalances, cisterns, and catches. Circumstances under which dams are erected in shafts or levels; mode of building them.

   Tubbing of water from shafts; conditions under which it may be done; details of the operation with various materials, wood, brick, stone, cast and wrought iron.

   Rails, waggons, and tubs for underground conveyance; employment of horses and of fixed steam engines for this purpose.

   Raising of the mineral through the shafts; various methods in use; chains, ropes (of hemp or wire), their weight, &c. Details of the best application of drums, cages, guides, keeps, and safety doors. Pulleys and shaft frames or poppet heads; protection against over-winding; safety clutches, &c. in case of breakage of rope.
9. Opening of ground; quarries and open work; driving of levels, various dimensions and directions according to circumstances; sinking of shafts, inclined or perpendicular; advantages of either kind under certain conditions; means of securing levels and shafts by timber or by walling; details of the various methods. Driving or sinking in heavy or running ground.
10. Working excavations; plan of laying them out, and means of security to be adopted whilst they are kept open. This will include the stoping of metalliferous veins, and the various modifications of post and stall, long-work, &c., which are applied to stratified deposits.
11. Travelling in shafts; prevention of accidents by proper fitting and dividing; mode of placing ladders and sollars; lifting machine for men, construction and advantages of.
12. Dressing of minerals. Arrangement of dressing floors. Construction of crusher and stamps; washing of coal; jigging, concentration, and separation of metallic minerals.

Examination for Honours.

Questions at the discretion of the Examiner, who will have regard to a general knowledge of mining as carried on in this and other countries, and may require certificates from employers as to practical work.

The student may be advised among other sources of information to consult the following works:—

De la Beche's *Report on Cornwall and Devon.* Professor Phillips's *Manual of Geology.* Wallace's *Lead Veins of Alston Moor*, Stanford, 1861. Greenwell's *Treatise on Mine-Engineering.* Dunn on the *Winning and Working of Collieries.* Hedley on *Colliery Working and Ventilation.* Smyth's *Rudimentary Coal and Coal Mining.* Evidence before Committees of the Houses of Lords and Commons on *Accidents in Mines.* Reports of H.M. Inspectors of Coal Mines. Transactions of the Northern Institute of Mining Engineers. Whitney's *Metallic Wealth of the United States*, 1854. Burat's *Géologie Appliquée.* Cotta's *Die Lehre von den Erzlagerstätten.*

Subject XIX.—Metallurgy.

For the first stage or elementary course the student will be expected to answer questions under the following heads, exclusive of those in italics.

The second stage or advanced course will include these. The student will also be required to make sketches and name unlabelled specimens.

For honours the candidates will be asked questions at the discretion of the Examiner, who will have regard to the present state of metallurgical science as carried on in this and other countries.

On certain Physical Properties of Metals.

Physical State. Action of Heat. Specific Gravity. Crystallization. Varieties of Fracture. Malleability. Ductility. Tenacity. Toughness. Softness. Elasticity. Conduction of Heat and Electricity. Capacity for Heat. Expansion by Heat. Opacity. Lustre. Colour.

General considerations on Metallurgical Processes.

Classification of Processes.

Explanation of the Terms.— Ore, "native" veinstuff, matrix or gangue, "dressing." Reduction. Reduction by Carbon. Smelting. Flux and Slag. Regulus. Speise. Roasting. Distillation. Sublimation. Liquation.

Slags.—Atomic constitution of silicates. Constitution. External characters. Brittleness and toughness. Colour. Fusibility. On the fusibility of certain compounds not containing silica, aluminates, &c. Sesquioxide of iron and lime. On fluor spar as a flux. *Melting points of silicates as indicated by the fusion of alloys of gold and platinum. Supposed sulphosilicates.*

Fuel.

On the calorific power of fuel. Berthier's process of estimating the calorific power of fuel. On the calorific intensity of fuel, and theoretical computation.

Wood.—Kinds of wood employed as fuel. Elementary composition of dry wood. Proportion of water in wood. Specific gravity of wood. Proportion of ashes yielded by wood. Approximate composition of the ashes of wood. On the rapidity of growth of wood. Weight of wood. Cutting and storing of wood intended as fuel.

Peat or Turf.—Specific gravity of peat. Composition of peat. Approximate composition of the ashes of peat. *Proximate composition of peat.* Extraction and desiccation of peat.

Coal.—Definition of coal. Ashes of coal. Lignites. *Classification of lignites according to external characters.* Approximate composition of glinites. Bituminous coals. Caking coal. Free burning coal. Cannel coal. Anthracite. *Fibrous and granular matter in coals.* Composition of bituminous coals to be given generally and approximately for each class. *On the occurrence of certain metals in peat and coals. Frémy's chemical researches on combustible minerals.*

Charcoal.—*Specific heat* and specific gravity of charcoal. Proximate composition of charcoal. Various modes of charcoal burning. Charcoal burning in piles or stacks. *Chinese methods of charring in pits.* Yield of charcoal. Yield by volume. Yield by weight. Influence of temperature upon yield. *Theory of charcoal burning in circular and rectangular piles.* Peat charcoal or coke. *Carbonization by superheated steam.*

Coke.—Properties of coke. Approximate composition of coke. Presence of water in coke. General principles concerning the preparation of coke. Coking in circular piles and in long piles or ridges. Coking in large open rectangular kilns. Coke ovens. *Cox's coke oven. Coke oven of the Brothers Appolt. Composition of the waste gases of coke ovens. Economic application of the waste gases of coke ovens. Davis' Breeze-oven. Mineral charcoal.* Coking of non-caking coal slack by admixture with pitch. *Collection of products of economic value generated during the process of coking.* Desulphurization of coke.

Combustible Gases.—Carbonic oxide. Hydrogen. Hydrocarbons.

Comparison of fuels in regard to calorific power. *Calorific power calculated from ultimate composition.*

NATURAL REFRACTORY MATERIALS EMPLOYED IN THE CONSTRUCTION OF CRUCIBLES, RETORTS, FURNACES, &c.

Fire Clays.—Approximate composition. Mode of testing.

Crucibles.—Earthen or clay crucibles. *Stourbridge clay crucibles. Cornish crucibles. London crucibles. Hessian crucibles. French crucibles. Belgian crucibles.* Graphite, black-lead, or plumbago crucibles. Lining crucibles with carbon.

Furnaces.—Sefström's blast furnace. *Deville's blast furnace.*

Fire Bricks, &c.—Stourbridge fire-brick. Dinas fire-brick. Sand and sandstones.

COPPER.

Colour. Lustre. Crystalline system. Malleability and ductility. Tenacity. Specific heat. *Linear dilatation by heat.* Action of heat. Atomic weight. Action of oxygen. Dioxide of copper. Protoxide of copper. Dioxide and protoxide of copper heated with silica. *Borates of copper.* Disulphide of copper. Disulphide of copper heated with access of air. Theory of the process of heating disulphide of copper with free access of air, or roasting. Disulphide of copper heated in admixture with dioxide, protoxide, or sulphate of copper. *Dioxide of copper heated with protosulphide of iron and silica. Disulphide of copper exposed to the action of hydrogen and water at high temperatures. Metallic copper exposed to the action of the vapour of water at high temperatures. Disulphide of copper heated with carbon, with iron, with zinc, with lead, with tin, with antimony. Copper heated with tersulphide of antimony. Disulphide of copper heated with nitre, with caustic soda, with carbonate of soda, with baryta or lime, with cyanide of potassium.* Copper and dioxide of copper. Copper and carbon. Overpoled copper. Copper and nitrogen. Copper and phosphorus. Copper and arsenic. Copper

and silicon. Specific gravity of copper. *Electric conductivity of copper. Influence of various foreign matters on electric conductivity.*

Meaning of the word Standard.

Ores of Copper.

Native copper. Red oxide of copper. Black oxide of copper. Green carbonate of copper or malachite. Blue carbonate of copper. Vitreous or grey sulphide of copper. Purple copper ore. Copper pyrites or yellow copper ore. True grey copper ore or fahlerz. Chrysocolla. Atacamite. Copper ores of Cornwall and Devon.

Copper Smelting.

In Reverberatory Furnaces.

The Welsh Process of Copper Smelting.—Furnaces employed. Calciner Melting furnace. On the reactions which occur in the Welsh process of copper smelting. Calcination. *Composition of the gaseous products which escape from the ore-calciner.* Melting of the calcined ore. External characters of coarse metal. Composition of coarse metal. External characters of ore-furnace slag. Composition of the ore-furnace slag. *Specific gravity of the coarse metal and ore-furnace slag.* Calcination of the granulated coarse metal. Melting of calcined granulated coarse metal. White metal. Slag. Blue metal. Slag. Moss-copper. Roasting. Blister-copper. Roaster-slag. *Best selected process.* Refining.

On the Elimination of the following Foreign Metals during the Welsh Process of Copper Smelting.—*Arsenic, antimony, tin, nickel, cobalt, gold, and silver.*

Various proposed improvements in Copper Smelting Furnaces. Napier's process. Method of smelting proposed by MM. Rivot and Phillips. Smelting rich copper slags in a blast furnace.

In Blast Furnaces.

Copper smelting in Japan. Copper smelting in Sweden.—Ore-furnace. Black copper furnace. Refining-hearth. Roasting or calcination. Fusion of the roasted ore. Roasting of the regulus from the last operation. Fusion for black copper. Refining. Toughening. Copper rain. Loss in smelting. *Smelting of copper schist in Prussian Saxony. Copper smelting in Perm in Russia. Cupriferous pig iron. Theory of the process. Kernel-roasting at Agordo.—Composition of the ore. Roasting. Styrian kilns. Mode of charging. Changes which the ore undergoes during roasting. Theory of the process.*

Wet methods of extracting copper.

Precipitation of copper from solution by iron. Bankart's process. Wet process by M. Escalle. Hähner's patent.

Assaying of copper ores by dry and wet methods. Comparative results by Cornish and wet methods.

Loss of copper. Impurities occurring in commercial copper.

ZINC OR SPELTER.

Physical and *chemical* properties of zinc. Atomic weight. Action of oxygen. Oxide of zinc. Action of water on zinc. Reduction of oxide of zinc by carbon and carbonic oxide. Reduction by hydrogen.

Silicate of zinc. Reduction by carbon.

Oxide of zinc heated with boracic acid.

Sulphide of zinc. Heated with access of air, with oxide of zinc, *with carbon, with various metals, in the vapour of water, with carbonic acid,* with nitre or nitrate of soda, with carbonate of potass or soda, *with lime.*

Zinc and phosphorus. Zinc and arsenic.

Ores of Zinc.

Calamine. Electric calamine. Blende.

Methods of Extracting Zinc.

English Process.—Roasting or calcination of the blende. Pots and condensing tubes. Reduction house. Mode of making the pots. Mode of charging the pots, and management of the furnace. Treatment of the rough zinc.

Silesian Process.—Retorts and appendages. Clay nozzles or condensers. Laggins or stoppers. Iron appendages. Description of the furnace. Calciner. Distillation of zinc. Melting of distilled zinc.

Belgian Process.—Retorts and appendages. Description of the furnace

Carinthian Method.

Zinc fume. Montefiori furnace. Foreign matter in commercial zinc. *Proposed improvements in the extraction of zinc.*
Methods of assaying Ores of Zinc.

Brass.

Definition. Malleability. Process of stamping. Dead-dipping. Physical properties of various alloys of copper and zinc.

Preparation of Brass.—Manufacture of calamine brass. Direct preparation of brass. Muntz's metal. Defects occurring in brass. Colouring and lacquering.

IRON.

Physical Properties of Iron.

Crystalline system. Magnetism. Tenacity or tensile strength. Specific heat. *Dilatation by Heat.* Action of heat. Welding. "Burnt Iron." Crystalline and fibrous iron. Effect of cold hammering upon iron.

Chemical Properties of Iron.

Atomic weight.

Iron and Oxygen.

Protoxide of iron. Sesquioxide or red oxide of iron. Hydrated sesquioxide of iron. *Sesquioxide of iron and lime.* Magnetic oxide of iron. Iron scale, or hammer slag. *Ferric Acid.*

Iron and Water.

Preservation of iron from rust.

Iron and Sulphur.

Disulphide of iron. Protosulphide of iron, *exposed to the action of vapour of water at a high temperature. Protosulphide of iron heated with carbon, with sesquioxide of iron, with sulphate of protoxide or sesquioxide of iron, with protoxide of lead, with other metallic sulphides, with silica, with silica and carbon. Sesquisulphide of iron.* Bisulphide of iron, or iron pyrites. Magnetic pyrites. Sulphate of protoxide of iron, copperas,

or green vitriol. *Neutral tersulphate or sesquioxide of iron.* Sulphides of iron roasted with access of air.

Iron and Nitrogen.

Results of experiments. *Passivity of iron.*

Iron and Phosphorus.

Phosphides of iron. *On the action of carbon on iron containing phosphorus.* Phosphate of protoxide of iron. Phosphate of sesquioxide of iron. *On the action of iron at a high temperature upon phosphate of lime in the presence of carbon.* Ditto in the presence of carbon and free silica. *On the action of phosphorus on iron containing sulphur.*

Iron and Arsenic.

Case-hardening of iron or steel by arsenic.

Silicon.

Silicon and nitrogen.

Manganese and Silicon.

Iron and Silicon.

Reduction of silica by carbon in the presence of oxide of iron and other bases. Protoxide of iron and silica. Reduction of silicate of protoxide of iron by carbon. *Silicate of sesquioxide of iron. Tribasic silicate of protoxide of iron heated with access of air. Liquation of silicate of protoxide of iron containing phosphorus.*

Iron and Boron.

Protoxide of iron and boracic acid. Sesquioxide of iron and boracic acid.

Iron and Carbon.

Modes of effecting the combination of carbon with iron. Cementation. *Action of carbonic oxide upon iron. Action of solid carbon upon iron. In an atmosphere of carbonic oxide. In an atmosphere of hydrogen.* Amount of carbon in iron. Maximum amount of carbon capable of being taken up by pure iron. *Iron, manganese, and carbon.* Modes of existence of carbon in iron, grey, white, and mottled cast iron. Chill-casting. Spiegeleisen, or specular cast iron. *Action of silicon on iron containing carbon. Action of sulphur on iron containing carbon. Abstraction of silicon from cast iron by fusion with sesquioxide of iron alone, and with the addition of manganese.* Carbonate of protoxide of iron. *Action of dilute sulphuric or hydrochloric acid on white and grey cast iron.* Action of sea water on cast iron.

Alloys of Iron.

Iron and copper. Iron and zinc. Process of zincing or galvanizing iron. Iron, copper, and zinc. Keir's patent. *Aich-metal. Sterro-metal.* Iron and manganese. Iron and tin. *Hardening the tops of rails with tin. Stirling's patent. Action of tin on cast iron. Iron and titanium. Iron and lead. Iron and antimony. Iron and bismuth. Iron and nickel. Iron and cobalt. Iron and mercury. Iron and silver. Iron and gold. Iron and platinum. Iron and rhodium. Iron and aluminium. Iron and chromium. Iron and tungsten.*

Ores of Iron.

Magnetic oxide of iron, magnetite. *Franklinite.* Red hæmatite, red ore, anhydrous sesquioxide of iron. Brown hæmatite, brown iron ore,

or hydrated sesquioxide of iron. Spathic carbonate, or sparry iron ore. Argillacious iron ores, clay or clayband ironstones.

Assaying of iron ores by dry and wet methods.

DIRECT EXTRACTION OF IRON IN THE MALLEABLE STATE FROM THE ORE.

Iron Smelting in India, Burma, Borneo, Africa, and Madagascar.

Catalan Process.—Trompe, or blowing machine. *Its advantages and disadvantages.* Water wheel, hammer, and anvil. *Theory of the process. Conditions affecting the quality of the iron produced in the Catalan furnace.* Characters of the iron produced.

The Osmund furnace. Stückhofen of High Bloomery Furnace. *Clay's process. Renton's process. Chenot's process.*

INDIRECT EXTRACTION OF IRON IN THE STATE OF CAST IRON FROM THE ORE.

Chemical phenomena of the modern blast furnace.—Description of the blast furnace. Foundation. Hearth. Twyer openings. Twyer. Tunnel head. Bracing. Blast main. Blast pipes. *Blast engines.* Cinder tubs. *Swedish charcoal blast furnace*:—*Mine kiln. Pressure of the blast. Temperature of the blast. Iron ores employed. Most important iron mines in Sweden. Smelting of lake and bog iron ores in Sweden.*

Hot Blast.—Neilson's patent. When first put into operation. Apparatus for heating the blast. *Neilson's first apparatus. Cast-iron tubular oven.* Syphon pipe oven. *Box-foot pipe oven. Spiral pipe oven. Pipe-within-pipe oven. Gas oven. Round or oval oven. Theory of the hot blast.* Saving of fuel. *Water-twyers.*

The Gases of Iron-smelting Blast Furnaces.—Composition of the gases of the Furnace. *Production of cyanogen in the blast furnace. Temperature of the blast furnace at different depths.* Utilization of the gases escaping from blast furnaces. "The waste gas." Modes of taking off the gases with open-mouthed furnaces. Ditto with close-mouthed furnaces. *Solid matter carried over with the waste gas.*

On the best form of the blast furnace. Decrease in volume which the materials undergo during their descent. Elliptical furnace. *Rectangular or Rochette furnace. Blowing in a blast furnace.* Tapping. Sand-bed for casting. Derangements in the working, scaffolding, and slips. Loss of iron in the slag. *Indications afforded by colour of slags. Spontaneous disintegration. Potash in slags. Accidental products of blast furnaces. Silica. Furnace cadmia or calamine. Cyanonitride of titanium. Graphite or kish.* Reduction of phosphoric acid in the blast furnace, and passgae of the phosphorus into the pig iron. Economical application of blast furnace slags. *Effects of long continued heat upon sandstone in the hearth bottom. Substitution of lime for limestone as a flux. Application of chloride of sodium.* Explosions in blast furnaces. Poisoning by gas accidentally escaping from blast furnaces. Yields of blast furnaces.

VARIOUS KINDS OF PIG IRON.

Spiegeleisen. Pig iron made from magnetic iron ore. Do. from red hæmatite. *Do. from brown hæmatite. Pig iron produced exclusively from Northamptonshire ore.* Do. wholly or chiefly from argillaceous iron ore of the coal measures. *Yorkshire. Derbyshire. South Staffordshire. North Staffordshire. South Wales. Do. from Cleveland ore. Titaniferous pig iron.*

On the Production of Malleable Iron from Cast Iron.

South Welsh process. The hollow fire.

Swedish Lancashire Hearth. *Walloon process, as conducted in Sweden. Carinthian process.* Slags or cinders produced in finery processes.

Running out fire or refinery. Composition of refined iron; do. refinery slags or cinders.

Puddling. Puddling furnace. Invention of iron bottoms; manipulation; theory of the process; composition of tap cinder; invention of the boiling process; double puddling furnaces.

Mechanical puddling. Application of waste blast furnace gas to puddling. Siemens' gas puddling furnace. Principle of the furnace. The gas producers. Construction. Puddling with dried wood. Stamping and assorting puddled balls. Utilization of the waste heat of puddling furnaces.

Working of the Ball.

Forge hammers.—Tilt hammers. Helves or lift hammers. *Steam forge hammers.—Nasmyth's. Condie's.*

Squeezers.—Crocodile. Horizontal rotary. Vertical rotary. *Brown's shingling machine.* Puddling or puddle rolls. *Composition of puddled bars.*

Working of the Puddled Bar into Merchant or Finished Iron.

Reheating furnace. With coal as fuel. With gaseous fuel, or gas-welding furnace.

Piling. Accidents in rolling mills. *Yield of puddled and finished iron.* Manufacture of rails. *Composition of the cinder from the reheating furnace.*

Varieties of Sheet Iron and Slit Rods.

Tin plates. Charcoal plates. *Coke plates. Belgian sheets. Russian sheets. Slit rods.*

Special Qualities of Iron.

South Yorkshire. Process of manufacture at Lowmoor, Bowling, and Farnley. South Staffordshire. *Swedish iron. Dannemora. Russian iron.* Boat plates. *Armour plates; rolled; hammered. Mending broken rolls.*

Steel.

Production of Steel by the Addition of Carbon to Malleable Iron.

In the direct reduction of iron ores at one operation. In the Catalan process. In crucibles. In converting furnaces.

Carburization of iron as a distinct process. Carburization of pulverulent iron. *Chenot's process.* Carburization of bar iron. Converting furnace. *Carburization by gaseous compounds of carbon.*

Carburization by fusing compact iron with carbonaceous matter. *Hindoo process. Wootz. Mushet's steel.*

Production of Steel by the partial Decarburization of Cast Iron.

Production of steel by fusing in hearths. *Production of steel by puddling.* Composition of puddled steel. *Uchatius process.* Partial decarburization of pig iron by cementation.

Production of Steel by Fusion of Pig Iron with Malleable Iron.

Immersion of malleable iron in molten cast iron.

Production of Steel by Blowing Atmospheric Air through Molten Pig Iron.

Bessemer process. Description of the apparatus.

Parry's process of manufacturing iron and steel.

Casting of Steel.

Furnaces and crucibles. Fusion of steel in the reverberatory furnace. *The addition of manganese in the casting of steel.*

Manipulation of Steel.

Hardening and tempering steel. *Metallic baths for the use of working cutlers.* Theory of hardening and tempering steel. Hammering steel. Welding steel. Shear steel. *Casting steel on wrought iron. Damaskeening.*

Permanent expansion of cast iron by exposure to long continued heat at or above redness. Dilatation of cast iron by heat.

LEAD.

Physical Properties.

Dilatation by heat. Conductivity for heat and electricity.

Chemical Properties.

Action of heat. Autogenous soldering. Action of air upon lead. Action of water upon lead. *Action of carbonic acid upon lead. Action of dioxide of copper upon lead. Action of acids upon lead.*

Lead and Oxygen.

Protoxide of lead. Mode of formation by dry and *wet* methods. Physical characters of massicot and litharge. Action of heat. Action of carbon. *Action of hydrogen. Action of carbonic oxide.* Fusibility with metallic oxides. *Action of metals upon.*

Dioxide of lead.

Binoxide of lead. Mode of formation.

Sesquioxide of lead.

Red lead. Process of manufacture. Physical and *chemical* properties. Action of heat. *Action of acids.*

Lead and Sulphur.

Sulphide of lead. Physical and chemical properties. Action of heat and air upon sulphide of lead. In the presence of iron pyrites. In the presence of blende. *Action of hydrogen upon sulphide of lead. Action of steam.* Action of protoxide of lead. Action of silicates of protoxide of lead. *Action of alkalies. Action of carbonate of soda.* Action of cyanide of potassium. Action of alkalies and alkaline carbonates and carbon. Action of lime and carbon. *Action of peroxide of iron and carbon.* Action of nitrate of potash. *Action of chloride of sodium.* Action of iron. *Action of tin. Action of copper.* Combination of sulphide of lead with other sulphides. *Subsulphides of lead.*

Sulphate of lead. Physical and *chemical* properties. Action of heat. Action of carbon upon sulphate of lead. Action of iron. Action of lead. Action of protoxide of lead. Action of sulphide of lead. *Action of chloride of lead.* Action of silica. Action of lime. Action of *chloride of sodium.* Action of cyanide of potassium. *Sulphate of lead and fluor spar.*

Lead and Phosphorus.

Phosphide of lead. Phosphates of lead.

Lead and Arsenic.

Action of arsenious acid on lead. Arseniate of lead.

Lead and Silicon.

Silicates of Protoxide of lead. Methods of formation. Fusibility. Action of carbon. Action of sulphur. *Action of sulphide of iron.* Action of iron. *Action of lime. Action of lime and carbon.* Action of peroxide of iron and carbon. *Silicates of protoxide of lead and potash. Silicates of protoxide of lead and lime. Silicates of protoxide of lead, lime, and alumina.*

Lead and Boron.

Borates of protoxide of lead.

Lead and Carbon.

Carbonate of lead. White lead. Action of heat.

Alloys of Lead.

Lead and antimony. Lead and zinc. *Lead and copper. Lead and iron. Lead and mercury. Lead and gold.* Lead and silver.

Ores of Lead.

Physical character and chemical composition. Galena or sulphide of lead. Minerals occurring with galena, Cerusite, or carbonate of protoxide of lead. Anglesite or sulphate of protoxide of lead. Pyromorphite or phosphate of protoxide of lead. Mimetisite or arseniate of protoxide of lead.

Methods of assaying of Lead Ores.

Extraction of Lead from the Ore.

In Air Furnaces.

Old English process. *Peruvian process. Spanish process.*

In Blast Furnaces.

Hindoo process.

Ore hearth.—Construction of the furnaces. Method of working. Nature of the products. *Chemical composition of the products. Chemical reactions which occur in the process.*

American ore hearth.—Peculiarity. Advantages.

German method with iron, or "precipitation process."—Description of furnaces. Mode of working. Nature of the products. *Chemical composition of the products. Chemical principles involved. Composition of lead speise.* Smelting of regulus.

German method with silicate of protoxide of iron, or iron refinery slags.

In Reverberatory Furnaces.

Derbyshire furnace.—Process. Description of the furnace. Nature and *composition of the products. Chemical reactions involved.*

Flintshire furnace.—Process. Peculiarities. Nature of the products. *Chemical composition of the products. Chemical reactions which occur. Action of lime.*

Cornish process.—Description of "calciner," and of "flowing furnaces." Nature of the products. *Chemical composition of products. Action of iron.*

Bleiberg process.—Peculiarities of the process. Character of furnace. Method of working. Nature of the products. *Chemical composition of products. Modifications of process.*

SMELTING OF LEAD SLAGS.

Slag hearth.—Description of furnace. Mode of working. *Composition of products. Chemical reactions.*

Spanish slag hearth.—Description of furnace. Mode of working. Nature of products. *Chemical composition of products.*

Smelting of Lead Fume.

Reduction of Litharge.

Softening of Hard Lead.

Smelting of Sulphate of Protoxide of Lead Ore.

Composition of the products.

EXTRACTION OF SILVER FROM LEAD.

Pattinson's process.—*Theory of the process.* Methods of working. Description of the apparatus. Mechanical appliances. *Limit of concentration. Effect of foreign metals.*

Parkes' process.—Methods of working. *Principles involved.*

English process of cupellation.—Construction of furnace. Mode of conducting the process. Nature of the products. *Chemical composition of the products. Chemical reactions.*

German process of cupellation (abtreiben).—Description of furnace. Mode of conducting the process. Nature of the products. *Chemical composition of products.*

Refining of "Blicksilber."

In open test. Under a muffle.

Apparatus for condensing Lead Fume.

Physical properties and *chemical composition* of lead fume.

Varieties of Lead in Commerce.

Impurities occurring in lead. *Methods of testing for metals present in lead.*

SILVER.

Physical Properties.

Dilatation by heat. Conductivity for heat and electricity. Specific heat.

Chemical Properties.

Action of heat. Action of heat and air. Action of nitre. *Action of chloride of sodium. Action of oxide of copper.* Action of protoxide of lead. *Action of sulphate of protoxide of copper.* Action of acids.

Silver and Oxygen.

Protoxide of silver. Physical and chemical properties. Methods of producing. Action of heat. Action of carbon. *Action of chlorine.*

Silver and Sulphur.

Sulphide of silver. Physical and chemical properties. Modes of formation. Action of heat. Action of heat and air. Action of heat and

air in the presence of iron pyrites, copper pyrites, *disulphide of copper, blende, and galena. Action of hydrogen. Action of steam.* Action of acids. Action of nitre. Action of iron. Action of lead. *Action of copper. Action of mercury.* Combination with other sulphides. *"Oxidized silver" process.*

Sulphate of protoxide of silver. Physical and *chemical properties.* Mode of producing action of heat. *Action of chloride of sodium.* Mode of formation of compound of sulphide and sulphate of silver. *Solubility in water.*

Sulphite of silver.

Hyposulphite of silver. Method of preparation. *Action of hydrochloric acid upon.* Action of hyposulphite of soda on chloride of silver.

Silver and Nitrogen.

Nitrate of protoxide of silver. Physical and chemical properties. Action of heat. Method of separation from nitrate of protoxide of copper. *Action of carbon and phosphorus upon solutions of.*

Silver and Chlorine.

Chloride of silver. Physical and chemical properties. Methods of formation by dry and wet processes. Methods of reduction by carbonate of soda, by carbonate of lime, by zinc. *Action of hydrogen.* Action of acids. Action of chloride of sodium. *Action of cyanide of potassium.* Action of iron. Action of lead. Action of *copper, tin, antimony, arsenic, mercury.* Action of sulphur. Action of metallic sulphides. Action of protoxide of lead.

Silver and bromine.

Silver and iodine.

Silver and Phosphorus.

Silver Arsenic.

ALLOYS OF SILVER.

Silver and lead. Silver and copper. Silver and mercury. Silver and gold. *Silver and zinc. Silver and palladium. Silver and antimony.*

ORES OF SILVER.

Physical and chemical characters. Native silver. Silver glance or sulphide of silver. Sulphide of silver and copper. Antimonial silver. Ruby silver or sulphide of silver and antimony. Brittle silver glance. Sulphide of silver and arsenic. Polybasite. Sulphide of silver, antimony, and lead. Horn silver or chloride of silver. *Bromide of silver. Iodide of silver. Metalliferous minerals containing silver.*

METHODS OF EXTRACTION.

Extraction of Silver from Argentiferous Copper.

Liquation process, or "Saigerarbeit."—Description of furnace. Mode of operation. Nature of the products. *Chemical principles involved.*

Extraction of Silver from the Ore.

Mexican amalgamation process.—Apparatus employed. Materials used. Method of working. *Specialties of the process.* Nature of the products. *Chemical principles involved.* Working of the silver amalgam. *Application of copper amalgam. Loss of silver in the process. Chloride of silver process.*

Freiberg amalgamation process.—Description of furnaces and apparatus. Mode of working. *Chemical principles involved. Composition of silver amalgam.* Method of separating the silver from the amalgam.

Amalgamation of argentiferous speise.

Amalgamation of argentiferous copper regulus.

Extraction of Silver from Argentiferous Regulus.

Ziervogel's process.—Description of the furnaces and apparatus employed. Method of operation. *Specialties of the process.* Nature of the products. *Chemical reactions involved in the various operations.*

Augustin's process.—Description of the process. *Chemical principles involved.*

Von Patera's method.—Apparatus used. Materials employed. Products obtained. *Chemical reactions in the process.*

Extraction of Silver from Ore by means of Lead.

Furnaces used. Method of working. Nature of the products. *Chemical composition of the products. Chemical reactions involved.*

Assaying of ores and alloys of silver by the dry and wet methods.

Methods of Plating or Silvering.

Old methods. On copper. On steel. Method of silvering without the use of "batteries." *Stripping of silver plate.*

Varieties of Silver in Commerce.

Metals occurring in silver. *Methods of testing silver for foreign metals.*

GOLD.

Physical Properties.

Dilatation by heat. *Conductivity for heat and electricity.*

Chemical Properties.

Action of heat.

Gold and Oxygen.

Protoxide of gold. Physical properties. Mode of preparation. Action of hydrochloric acid.

Teroxide of gold. Physical and chemical properties.

Gold and Sulphur.

Protosulphide of gold. Methods of formation. Physical characters.

Tersulphide of gold. Mode of producing. Physical characters. Action of heat. *Action of chlorine. Action of hyposulphite of soda. Action of potash.*

Gold and phosphorus.

Methods of combination. Physical characters. Action of heat.

Gold and arsenic.

Gold and Chlorine.

Protochloride of gold.

Terchloride of gold. Methods of formation. Action of oxalic acid, of sulphate of protoxide of iron, *of terchloride of antimony and of chloride of arsenic* on solutions of chloride of gold.

Preparation of purple of Cassius. Method of colouring "ruby glass."

Alloys of Gold.

Gold and Copper. *Gold and zinc.* Gold and silver. Gold and lead. *Gold and tin. Gold and antimony. Gold and iridium. Gold and platinum. Gold and palladium.* Gold, copper, and zinc. Gold, silver, and copper.

Use of the touchstone. Terms "standard" and "carat."

Ores of Gold.

Native gold. Physical character. Chemical composition. *Various metalliferous minerals containing gold.* Auriferous quartz.

Methods of Extraction.

Amalgamation of quartz containing gold.—Apparatus employed. Mode of working. Nature of the products. Extraction of gold from the amalgam. *Longmaid's process. Anossow's process by means of iron. Plattner's process by chlorine.*

Melting of Gold Dust.

Sweep Refining.

Separation of Gold from Silver and Copper. Parting.

Dry Methods.

By litharge and sulphur. By cementation. Description of process. *Chemical reactions. By sulphur.*

Wet Methods.

Nitric acid process.—Apparatus used. Method of working. *Chemical principles involved.*

Sulphuric acid process.—Apparatus employed. Mode of working. *Chemical reactions involved. Modifications of the process.*

Refining gold containing silver by chlorine.

Assaying of ores and alloys of gold by dry and wet methods.

Varieties of Gold in Commerce.

Methods of detecting copper, silver, lead, tin, antimony, platinum, palladium, and iridium in gold.

MERCURY OR QUICKSILVER.

Physical Properties.

Chemical Properties.

Action of heat. Action of air. *Action of acids. Action of chlorine.*

Mercury and Oxygen.

Suboxide. Physical and chemical properties.

Protoxide or red oxide. Mode of formation. Physical and *chemical* properties. Action of heat.

Mercury and Sulphur.

Subsulphide. Physical and chemical properties.

Protosulphide or vermilion. Methods of preparation. Physical and *chemical properties.* Action of heat. Action of heat and air. *Action of hydrogen.* Action of iron. Action of lime. *Action of alkalies. Action of chlorine. Action of acids.*

Mercury and Chlorine.

Subchloride. Physical and *chemical* properties.

Protochloride. Physical and *chemical* properties.

Amalgams.

Mercury and silver. Mercury and gold. Mercury and copper. *Mercury and iron.* Mercury and sodium.

Ores of Mercury.

Physical characters and *chemical composition.* Native mercury. Cinnabar. *Native amalgan. Fahlore containing mercury. Other minerals containing mercury.*

Methods of Extraction.

Description of furnace, method of operation, nature of the products, and *chemical reactions involved* in the following methods :—*Huanacavelica process. Almaden process. Idrian process.* Leopold furnace process. Alberti process. Hähner's furnace process. *Gallery furnace process. Fahlore process.*

Impurities present in mercury. Methods of testing mercury for foreign metals. Modes of purifying commercial varieties of mercury.

Water gilding.

Methods of assaying of ores of mercury.

COBALT.

Physical and *chemical* properties of the metal. Methods of preparation.

Cobalt and Oxygen.

Protoxide. Mode of formation. Physical and *chemical* properties. *Action of hydrogen.*

Sesquioxide. Methods of preparation. Physical and *chemical properties. Action of carbon.*

Cobalt and Arsenic.

Physical and *chemical* properties. Mode of producing compounds of *arseniate of cobalt.*

Ores of Cobalt.

Physical character and *chemical composition.* Cobalt glance. Smaltine. *Cobalt bloom. Nature of other minerals containing cobalt.*

Cobalt Products.

Smalts. Apparatus used in the manufacture of. Mode of preparation. Nature of the products. *Chemical composition of the products. Chemical principles involved.* Uses of smalts and oxide of cobalt.

Silicate of protoxide of cobalt. Mode of obtaining. Physical characters.

Rinmann's green. Mode of preparation. Nature of. Chemical composition.

Thenard's blue. Mode of preparation. Nature of. Chemical composition.

Phosphate of cobalt.

Printers' blue. Application. Mode of preparation. Nature of. *Chemical composition.*

Methods of estimating cobalt.

NICKEL.

Physical and *chemical* properties of the metal.

Nickel and Oxygen.

Physical and *chemical* properties of protoxide and peroxide of nickel. *Action of hydrogen. Action of carbon.*

Nickel and Sulphur.

Mode of obtaining compounds of. Physical and *chemical* properties.

Nickel and Arsenic.

Physical and *chemical* properties. Nickel speise. *Chemical composition. Pottery nickel. Action of heat and air upon arsenide of iron, cobalt, and nickel.*

Ores of Nickel.

Physical characters and *chemical composition.* Kupfernickel. Nickeliferous pyrites. Arsenical nickel. Nickel glance. *Millerite. Other minerals containing nickel. Meteoric iron.*

Methods of Extraction.

Apparatus employed. Mode of working. Nature of the products *Chemical reactions involved.*

German Silver.

Composition of the commercial varieties of. Mode of preparation. Physical characters.

Methods of assaying nickel ores.
Various alloys containing nickel.
Commercial varieties of nickel.
Foreign metals occurring in nickel.

ARSENIC.

Physical and *chemical* properties of the metal. Action of heat. Action of heat and air.

Arsenic and Oxygen.

Methods of preparation of the compounds of. Physical and *chemical* properties of the compounds of. *Action of light.* Action of heat. Action of *carbon.* Action of *hydrogen.* Action of *carbonic oxide.*

Arsenic and Sulphur.

Methods of obtaining the compounds of. Physical and *chemical* properties. Action of heat. *Action of carbonate of soda and carbon. Action of cyanide of potassium.*

Ores of Arsenic.

Physical characters and *chemical composition.* Native arsenic. Realgar. Orpiment. Mispickel. Arsenical iron pyrites. *Other minerals containing arsenic.*

Methods used for obtaining White Arsenic.

Description of apparatus. Methods of working. Nature of products *Chemical reactions involved.* Methods of refining white arsenic. Description of apparatus. Mode of working. Nature of products.

Preparation of yellow arsenic glass. Chemical composition of.
Preparation of red arsenic glass. Chemical composition of.

Preparation of Metallic Arsenic.

Methods of estimating arsenic.

Applications of arsenic and its various compounds.

Nature and *chemical composition* of Emerald Green. *Scheele's green. Opalescent glass.*

Mode of producing Green bronze.

ANTIMONY.

Physical and *chemical* properties of the metal.

Antimony and Oxygen.

Methods of formation. Physical and *chemical* properties of the following oxides :—

Teroxide. Action of carbon. *Action of cyanide of potassium.* Action of sulphur.

Intermediate oxide.

Antimonic acid. Action of heat.

Antimony and Sulphur.

Tersulphide. Methods of formation. Physical and *chemical* properties. Action of heat. Action of heat and air. Action *of steam.* Action of carbon. Action of *carbonic oxide.* Action of cyanide of potassium. Action of nitre. Action of *iron.* Action of *copper.* Action of *tin. Action of acids.* Glass of antimony. Liver of antimony.

Ores of Antimony.

Physical characters and *chemical composition. Native antimony.* Antimony glance. Valentinite. Antimony ochre. *Red antimony. Other minerals containing antimony.*

Methods of Extraction.

Apparatus used. Methods of working. Nature of the products. *Chemical composition of products* and *chemical reactions involved* in the following methods :—Liquation process. Reduction by iron, English process. French method.

Alloys of Antimony.

Antimony and lead. Action of heat and air. *Antimoniates of protoxide of lead. Naples yellow.* Composition of type metal and stereotype metal. *Antimony and iron. Antimony and copper. "Regulus venus."* Antimony and tin. *Other alloys containing antimony used in the arts.*

Assaying of ores of antimony.

Foreign metals occurring in antimony. Methods of testing for foreign metals.

TIN.

Physical and *chemical* properties of the metal. Action of heat. Of air. Of heat and air. *Of acids. Action of tin on various metallic oxides.*

Tin and Oxygen.

Physical and *chemical* properties of the following : — Protoxide. *Sesquioxide.* Binoxide. *"Putty powder." Stannate of soda.*

Tin and Sulphur.

Physical and *chemical* of the following:—Protosulphide. *Persulphide.*

Tin and Chlorine.

Protochloride. Perchloride.

Tin and Arsenic.

ALLOYS OF TIN.

Tin and copper. Physical properties and composition of bronze. Bell metal. Speculum metal. Casting of Bronze. Tin and antimony. Britannia metal. *Tin and zinc.* Tin and lead. Pewter. Solder. Soldering. *Tin, lead, and copper. Roman pot metal. Other alloys employed containing tin. Bearing metal. Amalgam for electrical machines. Tin bronze. Tinning of brass pins.*

ORES OF TIN.

Nature and *chemical composition* of Cassiterite. "Stream tin." "Mine tin." "Wood tin." *Tin pyrites or bell-metal ore. Minerals occurring with tin ores.*

SMELTING OF TIN ORES.

In reverberatory and blast furnaces.—Description of furnaces used. Methods of working. Nature of the products. *Chemical composition of the products. Chemical reactions involved.* Refining of tin. *Oxland's process.*

Commercial Varieties of Tin.

Common tin. Refined tin. Grain tin. Block tin. *Foreign metals occurring in tin. Methods of testing for foreign metals.*

Assaying of tin ores.

BISMUTH.

Physical and *chemical* properties of the metal. Action of heat. Action of air. *Action of steam. Action of acids.*

Bismuth and Oxygen.

Teroxide. Mode of formation. Physical and *chemical* properties. Action of carbon. *Protoxide.*

Bismuth and Sulphur.

Tersulphide. Methods of formation. Physical and *chemical properties. Action of metals upon.* Action of heat. *Action of hydrogen.*

ALLOYS OF BISMUTH.

Nature and composition of alloys containing bismuth employed.

ORES OF BISMUTH.

Names of various minerals containing bismuth. *Physical characters and chemical composition of minerals containing bismuth.*

METHODS OF EXTRACTION.

Apparatus used. Description of processes, *and chemical actions involved in the various methods. Old methods.* Recent methods. Plattner's furnace.

Methods of estimating bismuth. Foreign metals occurring in bismuth. Methods of testing for foreign metals.

PLATINUM.

Physical and *chemical* properties of the metal.

Ores of Platinum.

Native platinum. Physical characters. *Metals occurring in. Minerals associated with.*

Methods of Extraction.

Wet method. Deville's method.

Melting of platinum. *Platinum black. Spongy platinum. Working of platinum.*

Subject XX.—Navigation.

First Stage or Elementary Course.

General Notions.—Figure of the earth; earth's diameter, axis, poles. Meridians; equator, equinoctial. Parallels of latitude; latitude, longitude. Difference of latitude; difference of longitude. Rhumb line; course; nautical distance, meridian distance; departure.

Examples of differences of latitude and longitude. The meridian distance is equal to the difference of longitude multiplied by cosine of latitude. When a ship is sailing on a parallel of latitude:— (1), given the distance made good and latitude to find the difference of longitude; (2), given the difference of longitude and the latitude to find the distance; (3), given the meridian distance and the difference of longitude to find the latitude.

The Compass.—Description; Points. Number of degrees, minutes, and seconds in a point, ½ point, ⅓ point, ¾ point. To reduce points and parts of points into degrees, minutes, and seconds, and conversely.

Variation of the Compass: easterly, westerly. How to be allowed (1) when it is required to find the true from compass course; (2), to find compass course from true.

Causes of Local Deviation.—How the amount of local deviation is ascertained practically; how allowed. Examples of correction of courses for variation and deviation.

Leeway.—Definition. Starboard tack, port tack, close-hauled. How leeway is to be allowed. Examples.

The Log.—Description. How divided.

Plane Sailing.—Construction of figures. Proof of formulæ used in plane sailing, viz., connecting nautical distance, difference of latitude, departure and course. Examples.

Traverse Sailing.—Definition of a traverse. To resolve a traverse. Construction of traverse table. Examples.

Middle Latitude Sailing.—To prove the formulæ used. Examples.

Second Stage or Advanced Course.

Mercator's Projection and Chart.—Description. How meridians are laid down, and divided for representation of the latitudes. Chief value of the chart is:—"That the angle which a straight line joining any two " places on a chart makes with the meridians is equal to that which the

" rhumb line joining the same two places on the globe makes with the " meridians": proof of this.

To draw a Mercator's chart. To find the latitude and longitude of any place on the chart, and *vice versâ*, from the latitude and longitude to find its place on the chart. To find the course between two places on the chart. To find the ship's place by the bearing of two known places or headlands. To lay down a rock, island, or headland from observed bearings. To find the distance between two places on the chart. From the course and distance run to find the place on the chart.

Proofs of rules used in Mercator's sailing. Examples.

Local Deviation.—More accurate account of the causes of sub-permanent and induced magnetism. Laws of induced magnetism in a ship. Semicircular and quadrantal deviation. Description of modes for ascertaining the amount of deviation.

Great Circle Sailing.—Given the latitude and longitude of two places to find the distance between them on a great circle. To find also the latitude and longitude of the vertex. To find a succession of points on a great circle between two places. Examples.

Errors to which the log is liable. Having given the apparent distance run with given known errors in log line and glass, to find the true distance.

To find the difference of longitude made on a traverse. Sea journal. Taking a departure. Log-board and log-book. Day's work. Examples.

Examination for Honours.

In addition to the above there will be required—

The proof of the rule for finding meridional parts, viz.:—

$$m=3\cdot8988495+\log.(\log.\cot.\tfrac{1}{2}\text{ colat.}-10).$$

Problems in Marine Surveying, &c.

Candidates for examination in this subject are recommended to use the following books:—

A Treatise on Navigation and Nautical Astronomy, by J. Riddle (*with Tables*), 2 vols., 11*s.* 6*d.* Tables separate, 5*s.*
(London, Simpkin & Marshall, 8th ed., 1864.)

Navigation and Nautical Astronomy, by H. W. Jeans, in two parts, 12mo., 5*s.* each, or in one vol. 9*s.*
(London, Longman, new ed., 1860.)

Or, *Navigation and Nautical Astronomy*, by Merrifield & Evers.
(London, Longman & Co.)

Nautical Tables from British Seamen, by James Inman, 8vo., 14*s.*
(London, Rivington, 1862.)

Subject XXI.—Nautical Astronomy.

First Stage or Elementary Course.

Definition.—Circles of declination or hour circles. Equinoctial points. Ecliptic, obliquity of ecliptic, signs of the zodiac. Precession of the equinoxes, circles of celestial latitude. Latitude and longitude of a celestial body.

Declination, right ascension, right ascension of the meridian, sensible and rational horizon. Zenith, nadir, vertical or azimuth circles or circles of altitude. Altitude, azimuth, and amplitude of a heavenly body. Parallels of altitude. Six o'clock hour circle. Prime vertical. Colatitude.

Proof that the altitude of the elevated pole is equal to the latitude of the observer. Illustration by diagrams; projections on the meridian and horizon.

Time. Apparent noon, apparent solar day, mean solar day, mean noon, equation of time. Sidereal day. To convert intervals of mean time into sidereal time, and *vice versâ*. Illustration of these definitions by diagrams. Difference between civil and astronomical reckoning of time. To convert arc into time, and time into arc.

To find the Greenwich date, the time at any other place and longitude being given. To take out the right ascension of the mean sun for a given mean Greenwich date.

The corrections of altitudes:—

1. *Dip.*—Proof that dip in minutes$=\cdot 9784\sqrt{h}$, h being reckoned in feet.
2. *Refraction.*—Why necessary? Show generally how it is measured. Refraction $=57''$ tan ZD nearly.
3. Correction for semi-diameters.
4. *Parallax.*—Horizontal parallax $\times$ cos. apparent altitude $=$ parallax in altitude.

Sextant.—Description. Adjustments, how to make them. Index error, how it may be found.

Chronometer.—Error and rate. Reading of the chronometer.

Equation of time.—How it is to be applied to the mean time to obtain the apparent time, and conversely.

To find the latitude by a meridian altitude of the sun: proof of the rule and examples. To find the latitude by a meridian altitude of a star.

By the moon:—

1. To find the mean time, and Greenwich date, of the moon's meridian passage on a given astronomical day in a giventitude.
2. To find the semidiameter and horizontal parallax of the moon for a given Greenwich date (mean time) from the Nautical Almanac.
3. To take out the moon's declination from the Nautical Almanac.
4. To find the altitude by the meridian altitude of the moon. Examples.

To find the mean time at any place and also the Greenwich mean time of the passage of a star over a given meridian on a given day, and the distance at which it passes north or south of the zenith. To find the latitude by the altitude, (1), of the sun; (2), of a star; (3), of the moon below the pole. To find the latitude by the altitude of the pole star. To find the variation or local deviation by the observed azimuth or amplitude of the sun. Proof of the rules for finding the azimuth and amplitude. Applications of the rules to find the variation or deviation.

To find the hour angle of a heavenly body east or west of the meridian. To compute the mean or apparent time at any place from the observed altitude of a heavenly body. To find the error and rate of the chronometer. To find the longitude by the chronometer.

Second Stage or Advanced Course.

For the advanced course, in addition to the above, the candidate will be required:—

To compute the reduction of the horizontal parallax.

To define the angle of the vertical, and to describe the method of computing it.

To compute the augmentation of the moon's semi-diameter.

To prove the following rules:—

1. For the reduction of the altitude of any celestial body observed at one place to what it would have been if observed at the same instant at another place.
2. For finding the latitude by the altitude of the pole star.
3. For finding the latitude by altitudes of any celestial body near the meridian.
4. For finding the hour angle of a celestial body from the observed altitude.
5. For finding the rising and setting of celestial bodies and twilight.
6. The error of hour angle for small errors in observed altitude, when least.
7. For finding the latitude and longitude by means of two altitudes.
8. For computing the altitude of a given celestial body for a given time.
9. The method of clearing a lunar distance from the effects of parallax and refraction.

And to work practical examples of all these rules.

To compute the latitude and longitude by double altitudes—1. By Ivory's method. 2. By the direct method.

To find the error of the chronometer by equal altitudes of the sun or of a fixed star. To compute the apparent altitude from the true altitude. To compute the longitude by an observed lunar distance. To describe Summer's method for finding latitude and longitude. Cyclones and tides.

Examination for Honours.

In addition to the above :—

Method of computing the moon's right ascension from an occultation of a fixed star. Longitude by eclipses of Jupiter's satellites. To find the position of an unknown star or comet by its distances from two known stars. Astronomical problems.

For studying this subject the same books are recommended as have already been given at the end of the courses on *Navigation.*

Subject XXII.—Steam.

First Stage or Elementary Course.

In the first paper the questions will be restricted to those portions of the syllabus comprised under the heads numbered 1, 2, and 3, or 1, 2, and 4 respectively, and the students will be expected to possess a fair elementary knowledge of the subject.

Second Stage or Advanced Course.

In the second or advanced paper the questions will bear upon those portions of the syllabus numbered 1, 2, 3, and 5, or 1, 2, 4, and 5 respectively, and a more exact knowledge of details will be expected.

Examination for Honours.

The range of subjects will be the same as in the advanced course, but the questions will extend over that portion comprised under the sixth head of the syllabus.

1. *Introductory Matter.*—The expansion of bodies by heat, the liquid and gaseous states of matter, the co-efficient of expansion, energy of the atomic forces, practical illustrations of the expansion and contraction of various substances; the temperature of bodies, instruments for measuring temperature, the thermometer, comparison of thermometers when differently graduated, pyrometers; the capacity of bodies for heat, the calorimeter; the conversion of work into heat and of heat into work, the consumption of heat in liquefaction and vaporization; the convection of heat, the method in which a large mass of water may become heated; the conduction of heat, good and bad conductors, experimental illustrations; the formation of vapour and steam, the boiling points of fresh and salt water, the causes which influence the boiling temperature of water, high-pressure steam, measure of steam pressure by atmospheres, steam when in contact or not in contact with water, the relation between the pressure, density and temperature of steam, the specific gravity of steam, the latent heat of steam, the quantity of water required to produce condensation, common and superheated steam, the analysis of sea water.

 The radiation of heat, the absorption of heat, the general relation between radiation and absorption, good and bad radiators of heat, experimental illustrations.

 The oxidation of metals, the effects of galvanic action.

2. *Steam Engine.*—Newcomen's atmospheric pumping engine, its defects; the discoveries of Watt, the separate condenser, the expansive working of steam, its economy, its value in regulating the power of an engine.

 Details connected with Watt's single-acting pumping engine; the steam cylinder, the valves connected with it, their action, the condenser, the air-pump, the foot valve, the delivery valve, the snifting valve, the hot well, the piston rod, stuffing boxes and glands, the parallel motion; the method of starting the engine, and of regulating its speed, the cataract.

 The double-acting condensing beam engine, the principle upon which it works; details of the various parts, the cylinder, how constructed, the ports or openings into the cylinder, the forms of slide valve in common use, the locomotive or three-ported valve, the lap on a valve, the eccentric, the lead of a valve, cushioning the steam, clearance, details of the piston, metallic packing-rings; the expansion valve, and the gear connected with it; the air-pump, condenser, the supply of water for condensation, blowing through, gauges for the condenser, the barometer gauge, method of estimating pressure by it, errors in this method, and correction of the same; the connecting rod, the strap gib and cutter, the parallel motion, the governor, the fly-wheel.

 The principle of an equilibrium valve, the double beat valve, the crown valve, the throttle valve, the gridiron valve.

 The high-pressure engine without condensation, the expansive principle as applied in the double cylinder condensing engine.

 The forms of boiler in common use: the Cornish boiler, the cylindrical boiler with internal flues, the vertical boiler, heating and fire-grate surfaces, the evaporative power of boilers, boiler chimnies; the strength of boilers, the use of stays, the proving of boilers. Boiler appendages; safety valves, reverse or atmospheric valves, communication or stop valves, the glass water gauge, steam pressure gauge, various forms, Bourdon's gauge, feed pumps.

3. *The Locomotive Engine.*—The general construction of a locomotive engine and boiler before the invention of Stephenson, the Killingworth engine; description of the Rocket engine by R. Stephenson as the type of the modern locomotive, the tubular boiler, the draught produced by the discharge of waste steam.

The arrangement of an engine, the cylinders, their position, steamways, ports, slide valve, water cocks, grease cocks, the piston and packing-rings, piston-rod, guides, connecting rod, eccentrics, the reversing or link motion, reversing lever, sector, expansive working, crank axle and driving wheels, power required for traction, adhesion of the driving wheels, counter weights to cranks, wheels and axles, axle-boxes, bearing springs, buffer and draw springs, friction brakes.

Details of the boiler; the fire-box, the inner and outer shell, ribs on the crown of the fire-box, the cylindrical barrel, the tubes, mode of fixing them, through tie rods, the ashpit, the smoke box, the blast pipe, mechanical action of the blast, the steam chest, the outer dome, the steam pipe, the regulator, safety valves, pressure gauges, whistles, blow-off cocks, feed pumps, Giffard's injector; evaporative power of the boiler, fire-grate and heating surface, combustion of fuel; the tender, water-tank, brake, feed pipes.

The permanent way; varieties of rails in common use, timber sleepers, transverse and longitudinal systems; jointing of rails, the fish joint; the tyres of wheels, their form, general description of switches and crossings.

4. *The Marine Steam Engine.*—Side lever engine, the oscillating engine for paddle-wheel steamers, the vertical trunk engine; the Gorgon engines, the object of this arrangement; other forms of engine. Engines for screw propellors, direct acting engines with or without multiplying gear, Penn's trunk engine, Maudslay and Field's return connecting-rod engine.

Details of parts connected with the working of a marine engine; the air pump bucket and valves, double-acting air pump, India-rubber disc valves, cylinder escape valves, bilge and feed pumps, expansion valves, expansion cams and gear. The method of reversing an engine when fitted with a single eccentric, reversing by a double eccentric, the link motion. Paddle wheels, feathering of the floats, disconnexion and immersion of wheels. The screw propeller, various forms, length, angle, pitch, and area of screw blade, disconnecting and raising the screw, the position of the screw propeller in the vessel, the slip of the screw, the method of receiving the thrust upon the vessel, soft metal bearings.

The marine tubular boiler, how constructed, gun-boat boilers, the steam-chest, fire-bridge and ashpit, the funnel and its casing, waste-steam pipe, water gauge, gauge cocks, pressure gauges, safety valves, reverse valves, stop valves, feed pumps, boiler hand-pumps, feed or donkey-engine, Kington's valves, blow-out cocks, brine-pumps and brine-valves, the methods of ascertaining the degree of saltness of the water in a boiler, amount of saltness permissible, formation of scale, superheating apparatus, surface condensation.

Practical working; getting up the steam, filling the boilers, laying the fires, attention to various parts of the engine while the steam is getting up, mode of starting, working the engines at moorings. Priming; its causes and remedies. Duties to machinery when under steam, boilers, fires, &c. Injection pipes. Kingston's valves. Leaks in engines. Bearings of engines. Expansive working. Management of fuel. Damages and repairs to boiler, &c., after accidents. Duties to engine, &c., on arriving in harbour.

5. *Calculations.*—Methods of measuring the efficiency of steam engines. The duty of an engine. The horse power. Mercantile or nominal horse power.

The indicator; the ends it fulfils, description of the instrument, the atmospheric line. Method of taking a diagram. The general configuration of diagram to be expected under various circumstances. Examination of the indicator-diagram when the steam is throttled; when expansive gear alone used, and in other cases. To ascertain the horse-power of an engine by means of the indicator. The indicator-diagram in a high pressure or locomotive engine.

The principle of the parallel motion of a beam engine.

6. *Calculations.*—Estimation of the work done in one stroke of the piston, the same taking clearance into account. To find the horse power from the evaporation in the boiler. De Pambour's theory. Velocity of maximum useful effect. To find the evaporation of a condensing engine of given dimensions and horse power, the piston moving with a given velocity with and without expansion. To find the pressure in the cylinder, knowing the effective evaporation. To find the diameter of a cylinder to work at a certain speed, knowing the evaporation. To find the evaporation in the boiler, knowing the diameter and velocity of the piston and the pressure of steam in the cylinder with and without expansion. The same for locomotive, Watt's engines, &c.

The screw—to find its area, to find also the angle of the helix or thread of the screw propeller, and the pitch. The power exerted by a screw. How far the slip depends on the form and dimensions of the screw. Motion of the paddle-wheels, &c. Consumption of fuel. Measure of the locomotive performance of marine steam engines. To find the angle the crank has moved through when the piston is at a given distance from the top of the stroke. Amount of work developed by the crank in a half-revolution. Length of the radius-bar in a side lever engine. Work done in the up and down stroke of the air pump. The best temperature for the condenser of a steam engine. Qualities of fuel, &c.

Diagram showing the relative motions of the slide and piston at every point of the stroke.

Dynamometer. To find horse-power of engine by means of it.

The text books specially recommended are—

The Marine Steam Engine, by Professor Main and Mr. Brown, R.N. (Longmans and Co.)
Main and Brown's *Indicator and Dynamometer*.
De Pambour's *Theory of the Steam Engine*.
Bourne's *Catechism of the Steam Engine*. (Longmans and Co.)

And for reference—

Clark on *Railway Locomotives*.
Bourne on the *Steam Engine*.
Bourne's *Examples of modern Steam, &c. Engines*.

Subject XXIII.—Physical Geography.

First Stage or Elementary Course.

For this stage or course it will be expected that the student shall understand and be able to express the simple facts of the science and explain the terms in common use. The following outline may be useful to the teacher as well as to the student:—

1. The form and motions of the earth. Its division into land and water. Size and shape of continents. Low lands, their position and the names by which they are known. High lands or plateaux. Hills. Mountains and mountain systems. Valleys.
2. The ocean and its extent. The names given to different parts. Its depth where known. Its saltness. The movements of the ocean. Marine currents. Waves.
3. Rivers and river systems. Lakes.
4. The air, its nature, extent, and principal uses. Permanent winds. Periodical winds. Storms.
5. Dew. Clouds and rain. Snow and hail. Nature of climate.
6. The nature of earthquakes. The nature of a volcano. Earthquake bands and bands of volcanic action. The simple phenomena of a volcanic eruption.
7. The mode in which plants and animals are distributed on the earth. The mutual relations of horizontal and vertical distribution. The meaning of representative species and the principal groups of plants and animals that represent others in different continents and large islands.
8. The different races of men. The mode in which they are now distributed on the earth.

The examination questions set in this elementary paper will not involve more than a knowledge of such facts as are taught in the ordinary text books.

For a *mere pass* it will only be required that the answers should be so far correct and definite as to show that reasonable care has been taken in explaining the subject, assuming ordinary intelligence and exertion on the part of a young pupil. For a *first class* in this stage sound elementary knowledge and clearness of definition will be indispensable.

Second Stage or Advanced Course.

The more advanced students, who come up in the second stage, will not pass without exhibiting something more than mere elementary knowledge. They must have a knowledge of principles as well as facts. They will be expected to have acquired—

a. So much elementary astronomy as relates to the position of the earth in the solar system, its magnitude and rotation, and the influence of the sun, moon, and other bodies distributed through space on terrestrial phenomena.

b. So much of elementary physics and inorganic chemistry as includes the nature and mode of action of the physical forces and the composition of rocks.

c. So much of elementary geology and mineralogy as includes a knowledge of the nature of rocks, their superposition, succession, and disturbances.

d. So much of palæontology as includes a knowledge of the distribution of life in time.

The bearing of these departments of knowledge on physical geography commonly so called should be understood. The terms used in them must be well appreciated and briefly defined when definitions are asked.

The following outline of the main subjects included in physical geography will show the nature of an advanced course of instruction.

1. Land. Relation of continents and islands. Protuberance of land and preponderance of land in one hemisphere. Form of extremities of land. Grouping of islands. The geographical axes of the two continents. Influence of the form of a coast line. Characteristic features of the various great masses of land.

2. Mountain axes and mountain systems. Details of the great mountain systems of the world, especially with regard to the continents. Relations of the different parts of the great mountain system of Europe and Asia. Isolated mountains and mountain system of Africa. Mountain system of America. Culminating points. Knots in mountain chains.
3. High plains or plateaux; their nature and position. Their relations with the geographical axes and to geographical structure. Examples of plateaux. Plateaux in small islands. Sierras or mountain ridges rising from plateaux. The drainage of plateaux by deep narrow valleys.
4. Low plains; their distribution and relation to high plains and mountains. The low plains of the principal natural divisions of the world. The steppes of Asia. Deserts of Africa and Arabia. Savannahs and prairies of North America. Silvas, Llanos, Pampas of South America. The characteristics of each. Valleys; their varieties and peculiarities. Difference between mountain valleys and the valleys of plateaux.
7. Water; its position on the earth. Natural divisions caused by the protuberance of parts of the earth. Oceans and inland seas. Depth of the ocean, and means of ascertaining its depth. Nature of the ocean floor. Form of the bottom of the ocean. Solid contents of water. Density of water under different circumstances. Effect of cold on water. Temperature of the sea. Colour of water.
8. Motion of water. Waves. The tidal wave. Currents. The principal stream currents. Drift currents. Irregular movements of water. Sargasso seas.
9. Circulation of water by rivers. Drainage areas and river basins. Nature of water sheds. Origin of rivers. Floods and flood moderators. River systems of the world. Rivers draining into the ocean. Rivers draining into lakes. Groups of lakes; their extent and peculiarities. Waterfalls and rapids.
10. Circulation of water in the interior of the earth. Course of rain water through rock. Issue of this water in springs. Temperature of springs. Mineral and gaseous contents of springs. Quantity of water issuing from springs, and of solid matter deposited by them. Variation of springs.
11. Conveyance of water by clouds, and its deposit as rain. Distribution of rain. Proportion of rainfall that runs over the earth's surface. Formation of snow. Circumstances under which it is formed and deposited. Snow line; its position in different parts of the world. Passage of snow into ice. Glaciers; their ancient and modern history. Glacial action; its nature and results. Icebergs—how and where formed; their influence. Hail; its formation and effects.
12. The atmosphere. Composition and properties of air. Its uses and effects on light. Its extent. Its colour. Effect of heat on the atmosphere. Waves of sound. Nature of wind. Permanent winds. Periodical winds. Circulation of the air by upper currents rom the equator to the poles, and corresponding return currents from the poles to the equator. Distribution of winds in both hemispheres. Special local winds and their cause. Various kinds of storm winds. Nature of cyclonic storms. Phenomena connected with such storms.
13. Phenomena of weather and climate. Causes that produce or modify climate. Lines connecting places having equal annual, equal summer, or equal winter heat. Value of such lines as indicating

climate. Conditions that affect weather and climate. Cycles of weather and climate. Changes of climate, and the cause of such changes.

14. Volcanic phenomena. General action of volcanoes. The conditions of a volcanic eruption. The parts of the world that contain volcanoes. Number of volcanoes in the different groups; their position and history of the eruptions. Inactive or extinct volcanoes. Pseudo-volcanoes and phenomena connected with decaying volcanic activity. Geysers, solfataras, and mud volcanoes. Volcanic action under the sea. Periods and cycles of volcanic disturbance. Earthquakes. Zones of earthquake disturbance. Relation of earthquakes to volcanoes. Periodicity of earthquakes.

15. Distribution of life on the earth. Persistence of life. Origin of species. Modification of species. Grouping of plants. Representative and typical species. Advance of certain forms of plant life. Migration and migratory powers of plants. Floras of different countries. Distribution of floras. Faunas, their distribution. Groups of characteristic animals. Migration and migratory instincts. Limitation of these instincts. Distribution of plants and animals in time. Extinction and replacement of species.

16. Distribution of man. Date of introduction of the human family. Early existence of certain typical groups. Mode in which these groups differ anatomically among each other. Mixed races. Migrating and settled races, and their mutual influence. Natural and artificial limits of extension of the various races. Influence of man on external nature.

Sound knowledge of the main facts and an acquaintance with the mode of action of natural causes to produce results will be expected from the more advanced students.

Examination for Honours.

For this examination it will be expected that the candidates shall not only be familiar with the ordinary facts and inferences, but that they should be able to give a tolerably complete outline in their own language of groups of facts and their mutual bearing, together with explanations of natural phenomena on which the principles of physical geography depend.

Sound knowledge acquired, not only from text books, but from a thoughtful examination of the views of various authors or from a personal study of the facts and phenomena will be expected from those who seek an honour certificate, and very clear and definite information on the subjects attempted will be indispensable.

For elementary instruction in physical geography there are several recognised text books. It unfortunately happens that in some of these the facts are incorrectly stated, and teachers employing them must be careful to make the requisite alterations in their course of teaching.

The following book, which has been recently published, is recommended :—

* *The World we Live in*, by D. T. Ansted.
(London, Allen & Co., 1868.)

Of somewhat older date are :—

Text Book of Physical Geography, by Dr. Page, 12mo., 2*s*.
(Edinburgh, Blackwood, 1863.)

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* This work contains a glossary of technical terms.

Outlines of Physical Geography, by E. Hughes, 12mo., 3*s*. 6*d*.
(London, Longman, new ed., 1866.)

Elementary Class Book of Physical Geography, by W. Hughes, 12mo. 1*s*. (London, Philip, 1866.)

The following will be found suggestive to teachers, but are hardly sufficiently complete to be available for students :—

Earth and Man; a Lecture by A. Guyot, *translated* by C. C. Felton, 12mo. 2*s*. (London, Bentley, 1865.)

Physical Geography for Schools, by M. F. Maury, 12mo., 2*s*. 6*d*.
(London, Longman, 1864.)

There is at present only one general work that comprises the whole subject of physical geography as required for the examination in the advanced course :—

Physical Geography, by D. T. Ansted, 8vo., 12*s*.
(London, Allen, 3rd ed., 1868.)

In addition to the following, many other works in special departments of the science will be found useful to the advanced student and to the candidate in honours :—

Physical Geography of the Sea, by M. F. Maury, 8vo., 5*s*.
(London, Low, 12th ed., 1866.)

Man and Nature, by G. P. Marsh, 8vo., 14*s*. (London, Low, 1864.)

Principles of Geology, by Sir C. Lyell, 2 vols. 8vo.
(London, Murray, 1866.)

Principles of Seismology, by R. Mallet, 2 vols. 8vo., 63*s*.
(London, Chapman and Hall, 1862.)

It is most desirable that this subject should be taught and studied with good physical maps at hand. For the elementary course is recommended—

Small Atlas, by Hughes.

For the advanced student :—

Physical School Atlas, by Johnston.

Larger Physical Atlas, by Johnston.

List of Science Schools, giving the Number of Students returned as under Instruction in May 1867 and May 1868, and the Number of Prizes and Medals obtained in those years.

Schools marked with an * are Navigation Schools not examined in May 1868.

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1867.	1868.	Increase.	Decrease.	Number of Prizes. 1867.	1868.	Number of Medals. 1867.	1868.
				ENGLAND.								
Abingdon	British School	Strange, Rev. W. A.	Davis, John	Gubb, Edwin J.	30	46	16	..	8	14	..	..
Accrington	Mechanics' Institution	Ingram, J.	Ratcliffe, Wm.	Isherwood, T.	21	29	8	..	10	18	..	..
Alderley Edge	Day School Room	Consterdine, Rev. J. W.	Wilkins, Alfred	Richardson, H.; Dale, J.	14	18	4	..	8	6	..	..
Almondbury	King James' Grammar School.	Hulbert, Rev. C. A.	Dyson, Edward	Jarmain, George; Easther, Rev, A.	28	26	..	2	..	2	..	..
Alnwick	Scientific and Mechanical Institution.	Granville, Rev. C.	Robertson, A. jun.	Muxlow, Thos.	..	28	28	..	..	..	..	..
Andover	British School	Clarke, T. P.	Footner, Richd.	Marriott, J. T.	45	39	..	6	3	6	..	..
Ashby-de-la-Zouch	Mutual Improvement Society.	Smith, H. E.	Dalby, John	Gibson, Geo. H.	37	19	..	18	2	8	..	..
Ashton-under-Lyne	Mechanics' Institution	Mason, Hugh	Hay, G.	Jones, Thomas	20	29	9	..	8	12	..	..
" "	Parish Church School	Tickell, Rev. T.	Hague, Robert	Lees, Robert W.	..	15	15	..	..	3	..	..
Bacup	Mechanics' Institution	Aitken, John	Pilling, James	Shore, T. W.; Thornley, G.; Tomkins, E.	51	42	..	9	7	27	..	..
Banbury	British School	Harrison, W. R.	Cadbury, James	Beale, J. H.; Owen, A.; Taylor, Chas.	66	48	..	18	21	8	..	1 B.
Barnsley	St. John's School	Allen, Thos.	Gration, Jas.	Brears, Wm.	17	18	1	..	..	1	..	..
Bingley	Mechanics' Institution	Irwine, Rev. A. P.	Todd, Thomas	Severs, George	..	17	17	..	..	3	..	..
Birmingham	Midland Institute	Martineau, Thos.	Smith, Edwin	Woodward, C. J.; Bulpitt, W. T.	135	152	17	..	20	49	..	1 B.
"	St. Barnabas School	Winter, Rev. S. W.	Bembridge, E.	Bulpitt, W. T.	61	57	..	4	26	13	..	..
"	School of Art	Cope, Chas R.	Laundy, E.	Raimbach, D. W.	55	75	20	..	23	33	1 S.	1 B.
"	Bloomsbury Institution	Milward, Rev. H. C.	Aston, John	Smith, D.; Smith, A. F.; Griffin, J. R.; Bulpitt, W. T.; Walton, W.	..	80	80	..	..	26	..	..
"	Clarendon Chambers	Manton, Henry	Southall, A.	Turner, John	..	11	11	..	..	8	..	..

Birstal	Mechanics' Institution	Heald, Rev. W. M.	Priestley, Jno. W.	Patchett, Isaac	..	26	26	..	..	22	..	..
Blackburn	Wesleyan School	Beads, James	Parkinson, Giles	Isherwood, Thos.	18	9	..	4	2	4	..	..
"	Mechanics' Institution	Hutchinson, R. H.	Hand, Thomas	Isherwood, Thos.	16	16	..	..	15	8	..	..
Blandford	Working Men's Club	Fincham, W. C.	Meikle, William	Payne, James, jun.	22	20	..	2	..	1	..	..
Bodmin	Literary Institution	Stokes, H. S.	Phillipps, Josias	Downing, S.	47	31	..	16	13	16	..	..
Bolton	Science and Art School	Powell, Rev. H.	Lowe, Rev. J.	Doman, Rev. J. G. Spriggs, C. Collins, J.	168	193	25	..	27	37	..	..
"	Mechanics' Institution	Harwood, Richard	Barton, Joseph	Spriggs, Chris.	79	67	..	12	27	16	..	1 B.
Breage	Literary Institution	Pridmore, Rev. E. M.	Argall, William	Foster, C. Le Neve	12	23	11	..	11	17	..	2 B.
Brimscombe	Reading Room	Lancaster, Thos.	Hassell, Chas.	Vick, Wm.	..	17	17	..	..	..	..	..
Bristol	Trade School	Moseley, Rev. Canon	Wilkson, John	Coomber, T. Plant, E. C. Welsh, J.	145	145	..	..	97	106	2 G., 1 S., 1 B.	1 G. 1 B.
Bromsgrove	Literary and Mechanics' Institution.	Murray, Rev. G. W.	Gibson, C. W.	Dodd, William	48	26	..	22	7	7	..	..
Burnley	Church of England Literary Institution.	Parker, Rev. A. T.	Briggs, B. W.	Shore, T. W.	55	58	3	..	14	14	..	..
"	Carlton Road School	Ashworth, D.	Graham, John	Grant, James	69	61	..	8	..	6	..	..
"	Westgate School	Massey, L.	Massey, John	Clement, L.	12	21	9	..	2	4	..	..
"	Mechanics' Institution	Shuttleworth, Sir J. P. K.	Sutherland, J.	Shore, T. W.	48	48	..	..	5	11	..	..
"	Grammar School	Shuttleworth, Sir J. P. K.	Sutherland, J.	Shore, T. W. Wilkinson, T. T.	50	40	..	10	..			
Bury	Athenæum	Hildyard, Rev. C. F.	Probert, T. W.	Spriggs, Chr.	72	79	7	..	27	25	1 S.	..
Camborne	British School	Smith, Geo.	Provis, Wm.	Foster, C. Le Neve	31	24	..	7	3	5	..	..
Canning Town	Holy Trinity Schools	Meyrick, Rev. M.	St. John, J.	Shipman, C.	..	12	12	..	..	5	..	..
Cardiff	Free Library	Lucas, C.	Price, Peter	Bush, J. Thomas, George	42	63	21	..	24	27	..	..
Chatham	St. Mark's School (New Brompton).	Neville, H. J. W.	Gifford, Geo. H.	Byatt, Horace Warrall, William	..	27	27	..	..	19	..	..
"	St. Mary's National School	Hills, V.	Coldwell, R. W.	Byatt, Horace	..	40	40	..	..	26	..	..
Cheltenham	Bedford Buildings	Downing, J.	Moore, H. J.	Notcutt, W. L. Ewens, F. T. Davis, W. S.	146	212	66	..	40	32	3 G.	1 G.
Chester	Mechanics' Institution	Frost, M.	Harris, Rev. Jas.	Craister, Walter	25	30	5	..	3	8	..	..
Chorley	National School	Stock, Rev. J.	Paton, Rev. J.	Brown, Thos.	20	20	..	..	7	7	..	..
Cold Norton	National School	Holland, Rev. W.	Kent, Rev. F. W.	Denyer, Elizabeth	..	13	13	..	..	..	..	..
Compstall	Athenæum	Andrew, Chas.	Fernley, John	Hurst, W.	..	27	27	..	..	20	..	..
Congleton	Wesleyan Schoolroom	Hadfield, W.	Jackson, Benj.	Greenwood, A.	21	12	..	9	..	2	..	..
Cradley	School Street	Thomson, Rev. J. H.	Gregg, Rev. T. H.	Hodgetts, Chas. B.	..	6	6	..	..	2	..	..
Crewe	Mechanics' Institution	Ramsbottom, James	Jackson, J. A.	Craister, W.	15	44	29	..	7	20	..	..
Croydon	Literary Institution	Carpenter, A.	Lanchester, H. T.	Sullivan, M. Jones, T. Furniss, T.	23	32	9	..	9	13	..	..
Culham	Training College	Pott, Rev. A.	Causton, Rev. F. J.	Gray, Rev. Chas.	..	27	27	..	..	3	..	..

List of Science Schools and Classes, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1867.	1868.	Increase.	Decrease.	Number of Prizes. 1867.	1868.	Number of Medals. 1867.	1868.
Darlington	Mechanics' Institution	Pease, Henry	Swinburne, T.	Weatherill, R.	12	13	1	..	1	6	..	..
Dartford	Working Men's Institute	Blomfield, Rev. G. J.	Perry, Arthur	Busbridge, Walter; Ellis, Alfred	..	36	36	..	..	27	..	..
Dartmouth	Mutual Improvement Society.	Newman, Aug.	Rees, W. H.	Andrews, Thos. N.	..	26	26	..	..	6	..	..
Darwen	Mechanics' Institution	Blamire, Rev. W. H.	Neville, E.	Isherwood, T.	29	14	..	15	2	3	..	..
Denton	Mechanics' Institution	Nicol, Rev. W.	Collins, John	Hurst, W.; Gee, William	10	33	23	..	1	12	..	..
Deptford	St. Paul's School	Lewes, Samuel S.	Hopper, Thos.	Busbridge, W.; Dorrell, H. B.	40	21	..	19	24	27	..	..
"	Christ Church School	Courtenay, Rev. J. P.	Carr, J. H.	Farncomb, Edw.	..	27	27	..	..	..	..	..
Derby	Grammar School	Roe, T., junr.	Longdon, F.	Greaves, C. A.	10	12	2	..	2	..	..	..
Dewsbury	Mechanics' Institution	Day, Edward	Woollons, Chas.	Shaw, John	..	17	17	..	..	1	..	..
Droylsden	Educational Institution	Hodwen, Joseph	Blackburn, Jas.	Hurst, W.; Richardson, Hy.	37	58	21	..	22	23	..	..
Durham	Training College	Henderson, W.	Earle, W. E.	Ashwell, Rev. A. R.; Powley, Rev. W.	..	29	29	..	..	14	..	..
Eagley	Eagley Institute	Greg, Arthur	Marson, Gervase	Pinnington, W.	..	31	31	..	..	5	..	..
Earlestown	District School-room	Whitley, Rev. J.	Shaw, Chas.	Stott, Henry, senr.	..	17	17	..	..	5	..	..
Eastington	National School	Peters, Rev. Thos.	Hooper, Chas. H.	Wilcox, Edw.	11	15	4	..	6	3	..	..
East Retford	National School	Gray, Rev. Chas.	Eaton, Rev. W. F.	Daffen, Thomas	..	55	55	..	..	..	..	..
Eastwood	Mechanics' Institution	Wright, F. B.	Plumptre, Rev. H. W.	Fisher, Henry	20	13	..	7	4	6	..	..
Elland	Mechanics' Institution	Farrar, John	Kaye, Uriah	Jarmain, G.	20	22	2	..	13	11	..	..
Exeter	10, Bedford Circus	Head, R. T.	Tucker, J. T.	D'Urban, W. S. M.; Perkins, F. P.; Sheppard, W.	37	32	..	5	15	11	..	..
Failsworth	Mechanics' Institution	Wright, Robert	Brierley, John	Stott, Hy. senr.; Stott, Hy. junr.	..	8	8	..	..	1	..	..
Falmouth	National School	Carne, W.	Hooper, Wm.	Shaw, H. C.	14	14	..	..	1	..	..	..
Gateshead	National School-rooms	Prest, Ven. Edw.	Arnold, Rev. R. S.	MacCallum, J.	..	39	39	..	..	13	..	..
Gloucester	Blue-coat School	Washbourn, B.	Fowler, Rev. Hugh	Jeffery, Walter	46	44	..	2	4	38	..	..
"	Free Library	"	"	Jeffrey, W.; Davis, W. S.	..	34	34	..	..		..	..

Greenwich	Literary Institution	Purvis, Prior	Jordan, C. H.	Jones, T. Duckett, W. Child, T. Conning, J. Browne, L. Jones, E. S. L.	50	42	..	8	52	24	..	1 B.
"	Girls' National School	Miller, Rev. J. C.	Howarth, W.	Wright, H. E. Gough, W. G.	..	20	20	..	..	11	..	..
Halifax	Working Men's College	Akroyd, Edward	Gibb, George	Jarmain, George	17	35	18	..	3	7	..	1 G., 1 B
Haslingden	The Institute	Thompson, Robt.	Binns, John	Shore, T. W.	19	18	..	1	4	3	..	..
Heywood	Mechanics Institution	Smith, Mark	Fairbrother, Geo.	Spriggs, Chr. Duerr, George	32	44	12	..	22	8	..	..
Hollinwood	Working Men's Club and Institute	Collinge, John	Wilde, John	Mellor, James Haslam, William	..	31	31	..	..	9	..	..
Huddersfield	Mechanics' Institution	Freeman, John	Bate, Joseph	Jarmain, George	16	23	7	..	3	9	..	..
Hull	Nautical Schools	Whitaker, Thos.	Wilson, Edward S.	Scaping, Z.	73	80	7	..	96	50	3 G. 2 S. 4 B.	2 G. 1 S. 1 B.
Huntingdon	Walden's School	Ward, W.	Vesey, Rev. F. Gerald.	Pascoe, John	20	16	..	4	7	3	..	..
Hyde	Mechanics' Institute	Hibbert, Edward	Lawton, Thos.	Gee, William Fallows, J. F. Parnell, George	60	41	..	19	21	17	..	..
Kettering	National School	Lindsay, Rev. H.	Eldred, Geo.	Sturgess, William	21	52	31	..	16	23	..	..
Kingsbridge	Town Hall	Davis, Rev. J. U.	Thomas, W. J.	Parkhouse, Henry	12	17	5	..	7	..	..	..
Kinver	National School	Hodgson, Rev. J.	Bolton, Thomas	Packer, M. W.	34	25	..	9	8	5	..	..
Lancaster	Mechanics' Insiitution	Howitt, Thos.	Moore, J. Daniel	Prosser, William	58	48	..	5	7	9	..	..
Leeds	Mechanics' Institution	Luccock, J. O.	Dayson, J. O.	Ward, George	39	47	8	..	5	25	..	1 B.
Lees	Parish Church Schools	Whitehead, Jas.	Whittaker, Rev. Robt.	Kershaw, Thomas junr.	..	33	33	..	..	11	..	..
Leicester	St. Martin's School	Vaughan, Rev. D. J.	Jones, H. S.	Atkins, Edward	40	53	4	..	5	16	..	..
"	Portland Street	Spittal, Rev. J.	Pertwee, Rev. A.	Poyner, H.	5	5	..	..	..	..	..	..
Limehouse	St. Anne's National Schools	Jones, Rev. E. R.	Chatterton, E.	Farncomb, E.	..	24	24	..	..	2	..	..
Liverpool	Free Library	Graves, S. R.	Gregson, S. Leigh	Carter, W.	68	60	..	8	13	18	..	..
"	Liverpool Institute	Robinson, Jno.	Sharp, Chas.	Ewart, E. B. Adair, S.	90	107	17	..	15	38	..	..
Llanelly	Copper Works School	Nevill, C. W.	Morgan, Rowland	Jones, John Jones, Mrs. Annie	49	73	24	..	11	28	..	..
London:—												
Bath Street	City Middle Class School	Rogers, Rev. W.	Wormell, Richd.	Davidson, Ellis A.	24	42	18	..	3	14	..	..
Battersea	Sir Walter St. John's School	Griffith, Rev. J. C.	Brown, Harry	Martin, James	63	53	..	10	45	..	2 B.	..
"	Training College	Ince, Rev. E. C.	Dugard, F.	Faunthorpe, Rev. J. P. Brown, G. C. Lewis, Hy. Roberts, Geo.	..	80	80	..	..	98	..	1 G. 1 S.

List of Science Schools and Classes, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1867.	1868.	Increase.	Decrease.	Number of Prizes. 1867.	1868.	Number of Medals. 1867.	1868.
London—*cont.* Bermondsey	Christ Church Schools	Martin, Rev. R. Marshall	Salter, J. H.	Jones, Thos.; Hepburn, R.; Lomas, C.	..	22	22	..	..	4	..	..
Bethnal Green	Birkbeck Schools	Rogers, Rev. W.	Rüntz, George	Pike, R. W.	130	106	..	24	15	33	1 B.	..
„	National School	Hansard, Rev. S.	Halliday, James	Simpson, B.; Duckett, J. B.	52	115	63	..	15	13	1 G.	..
Brixton Hill	Workmen's Hall	M'Arthur, W.	Gibbons, G.	Jones, Thomas; Bradbury, A. A.	..	9	9	..	..	8	..	..
Chelsea	St. Mark's Training College	Mayow, Rev. M. W.	Quilter, John S.	Eastburne, Rev. C. F.; Lawson, Wm.; Atkins, George	124	48	..	76	70	62	1 G. 1 S. 1 B.	..
„	Literary and Scientific Institution.	Dilke, Sir C. W.	Baker, St. Thos.	Bickerton, A. W.	..	153	153	..	..	46	..	1 S. 1 B.
„	St. Luke's Parochial School	Dilke, Sir C. W.	Baker, St. Thos.	Bickerton, A. W.	*	†	..	..	..	..	..	..
„	Royal Military Asylum	Mullen, Col.	Langmead, Rev. G. W.	Reynolds, W. J.	..	11	11	..	..	11	..	..
Dock Street*	Sailors' Home	Maude, Capt. the Hon. F., R.N.	Webb, Cap. W. H.	Newton, John	256	328	72	..	..	..	..	..
Gt. Ormond Street	Working Men's College	Maurice, Rev. F. D.	Rawlins, H. E.	Downar, G. F.	18	15	..	3	4	2	1 S.	..
Hackney	St. Thomas Square School	Kirkus, Rev. W.	Reynolds, A. W.	Pike, R. W.	..	48	48	..	..	12	..	..
Islington	Lower Islington Public School.	Fleming, Rev. W.	Ross, John	Howard, J.; Angel, H.	109	145	36	..	35	38	1 B.	..
Knightsbridge	Albert Working Men's Club	Dilke, Sir C. W.	Baker, St. Thos.	Bickerton, A. W.	*	†	..	..	..	..	..	..
Lambeth	Boys' Schoolroom, Lambeth Green.	Bingham, J.	Codrington, Rev. J. E.	Jones, T.; Sullivan, M.; Duckett, W.; Griffiths, J. A.; Hernaman, J.; Brown, W.; Jones, E. S. L.	39	155	116	..	18	13	..	1 S. 1 B.
Leadenhall St.	City of London College	Mackenzie, Rev. C.	Maskell, Rev. J.	Gibsone, Rev. B. W.; Newlands, W.	34	30	..	4	..	..	..	..
Marylebone	Central Schools, High Street	Eyre, Rev. C. J. P.	Goody, Rev. C. J.	Jones, T.; Bradbury, A. A.	..	48	48	.	..	2	..	..
Paddington	Greville House, Paddington Green.	Ewart, W., M.P.	Deans, Charles	Jones, Thomas; Johnson, H.	..	31	31	..	..	10	..	..
Peckham	Upper and Middle Schools	Gray, R. A.	Hutchison, T.	Jones, A.	348	362	14	..	22	30	..	..

Regent Street	Royal Polytechnic Institution	Mackenzie, Rev. C.	Cousens, James	Hardy, James Downar, Geo. F.	47	46	..	1	20	19	..	1 G. 1 S. 3 B.
Southwark	Borough Road Training College	Cordery, J.	Wilks, E. D. J.	Smith, A. F.	..	69	69	..	..	28	..	..
Waterloo Road	St. John's Schools	Johnston, Rev. J. A.	Quail, W.	Busbridge, W. Dorrell, Chas. F.	..	30	30	..	..	33	..	..
West Brompton	Edith Grove School-room	Dilke, Sir C. W.	Baker, St. Thos.	Bickerton, A. W.	*	†	..	..	..	..	..	..
Westminster	Wesleyan Training College	Shaw, Rev. W.	Olver, Rev. G. W.	Sugden, W. Langler, J. R. Mansford, C.	..	29	29	..	..	28	..	..
Whitechapel	Mary Street	Cohen, Rev. J.	Roe, J.	Parry, P. Smith, H. H. Bartlett, H. G.	..	27	27	..	..	8	..	..
Macclesfield	Modern Free School	Wardle, Thomas	Brooker, John	Jackson, John	36	43	7	..	..	..	..	..
Maldon	Mechanics' Institution	Horwood, Rev. Edw. R.	Crick, Geo. E.	Goffin, Robt.	..	12	12	..	..	9	..	..
Manchester	Mechanics' Institution	Neill, Robert	Webb, Joseph B.	Angell, John Gee, William Mellor, James Tomkins, E.	239	200	..	39	58	64	1 B.	1 G. 1 S. 2 B.
"	Roby Educational Society	Callender, W. R.	Ellis, R. P.	Schofield, J. Almgill, T. Law, E.	31	39	8	..	6	9	..	..
"	Corporation Street	Booth, Geo.	Maybury, C. W.	Lightbown, J. H.	36	41	5	..	2	13	..	..
"	Ardwick Wesleyan School	Rumney, R.	Lawton, Thos.	Rayner, T. Hurst, W.	10	28	18	..	..	8	..	..
"	Hulme Working Men's Institution	Schofield, Thos.	Letch, G. A.	Richardson, J. Richardson, H. Jones, T.	46	31	..	15	8	12	..	..
"	St. George's National School	Lindsay, Rev. Thos.	Gregory, John	Schofield, J. Holl, J.	12	12	..	..	..	1	..	..
"	St. John Baptist	Marshall, Rev. P.	Cooper, L.	Winfield, B.	..	12	12	..	..	2	..	..
Melton Mowbray	Church School-room	Colles, Rev. W. M.	Greasley, J.	Ashwell, F.	..	3	3	..	..	..	..	..
Middlesborough	Church of England Institute	Smith, Rev. A. C.	Donaldson, Rev. A.B.	Stead, W.	6	11	5	..	..	8	..	..
Middleton	National School	Durnford, Ven. R.	Ward, Rev. C. B.	Wheeler Geo. H.	22	22	..	..	13	17	..	1 B.
Modbury	Mechanics' Institution	Green, Rev. Geo. C.	English, Rev. A.	Pady, Wm. J.	..	10	10	..	..	1	..	..
Mossley	" "	Jones, Rev. Geo. A.	Jackson, Thos.	Kershaw, Thos.	..	23	23	..	..	2	..	..
Nelson-in-Marsden	Lomeshaye Mills	Ecroyd, William	Waddington, J.	Clement, L.	27	36	9	..	21	23	1 B.	..
Newark	Mechanics' Institution	Godfrey, T. S.	Lammin, H.	Webster, Mr. Turnbull, Mr.	..	34	34	..	..	3	..	..
New Mills	" "	Rigg, Rev. John	Godward, Edw.	Hurst, W.	..	30	30	..	..	7	..	..
Newton Heath	All Saints School	Hutchinson, Rev. W.	Hudson, Thos.	Parnell, Geo.	..	18	18	..	..	5	..	..
Northampton	Guildhall	Compton, Rev. A.	Hensman, J. B.	Lees, Charles	..	115	115	..	..	30	..	1 B.
North Ormesby	Church Institute	Pennyman, J. S.	Moyle, Rev. V. H.	Weatherill, R.	7	7	..	..	4	4	..	..

† Included with Chelsea Lit. & Sci. Inst.

List of Science Schools and Classes, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1867.	1868.	Increase.	Decrease.	Number of Prizes. 1867.	1868.	Number of Medals. 1867.	1868.
Nottingham	Trinity School	Morse, Rev. Fras.	Thurlow, R.	Sissling, W. Taylor, A. C. Wilson, E.	35	61	26	..	4	17	..	..
Oldbury	National School	Bowlby, Rev. H. B.	Taylor, Rev. W. T.	Spencer, P.	..	61	61	..	..	12	..	..
„	Messrs. Chance's School	Chance, Hy.	Chance, A. M.	Hanson, Shaw	..	14	14	..	..	..	..	..
Oldham	Glodwick Mutual Improvement Society's Rooms.	Harrop, Eli	Green, Jeremiah	Kershaw, Thos., jun.	80	30	..	..	17	14	..	..
„	Science and Art School	Platt, Jno.	Bailey, Thos.	Mitchell, Thomas Bahin, C. P. Philip, J. Walters, Chas.	100	80	..	20	67	38	3 B.	..
„	Parish Church School	Bamford, John	Walters, Rev. W.	Mellor, Jas.	19	33	14	..	..	..	..	..
„	Analytical Society	Grimshaw, Jno.	Hall, Robert	Taylor, Wm. Haslam, Wm.	14	44	30	..	11	16	..	..
„	Temperance Seminary	Crompton, A.	Smethurst, Jas	Kershaw, Thos.	..	12	12	..	..	1	..	..
Padiham	National School	Fox, Rev. J. H.	Warburton, Rev. P.	Shore, T. W.	18	10	..	8	2	..	..	..
Patricroft	Mechanics' Institution	Wilson, Robt.	Hewitt, John	Tomkins, E.	..	27	27	..	..	17	..	1 S. 1 B.
Pendleton	„ „	Ashworth, Joseph	Clay, Jas., jun.	Beever, John	17	20	3	..	7	4	..	..
Penzance	School of Art	Prouse, F.	Rudd, W. H.	Geoffroi, H. M.	..	24	24	..	..	4	..	..
Plumstead	Burrage Road School	McAlister, Rev. J. A.	Hammond, Josiah	Farlie, C. J. Shipman, C. Swinger, W.	62	57	..	5	67	58	..	..
Plymouth	Buckwell Street	Risk, Rev. J. E.	Widlake, T. H.	Hearder, J. N.	18	13	..	5	3	6	..	..
„	Courtenay Street	The Mayor of Plymouth	Cawse, J. H. M.	Rickard, G. J. Evers, H. Rider, A. J. Hingston, A. C. Merrifield, J. Hodge, H. Balkwill, F. B. Robjohns, F. R.	154	163	9	..	63	81	1 S., 1 B.	1 G. 3 S, 4 B.
„	Navigation School	Hill, Richard	Cuming, W. B.	Merrifield, Jno.	..	344	344	..	..	..	..	..
Pontypridd	Science School	Davis, Rev. D. T.	Bassett, C.	James, John Roberts, John Roberts, Evan	17	13	..	4	16	..	..	..
Portland	The Grove School	Clifton, George	Hill, Rev. Arthur	Moore, Edw. W.	15	30	15	..	3	2	..	..
Preston	Institution, Avenham	Birley, E.	Dunn, Jas.	Spriggs, C.	37	57	20	..	9	30	..	1 S. 1 B.
Purleigh	National School	Tamplin, Rev. G. P.	Lufkin, Chas.	Goffin, Robt.	28	24	..	4	15	11	1 S.	..

Ramsbottom	Public Institution	Butcher, Rev. Jas. H.	Barlow, Richard	Jones, T.	..	17	17	..	..	5	..	..
Rawtenstall	Mechanics' Institution	Whitehead, J. B.	Wardleworth, W.	Tomkins, Edw.	..	55	55	..	..	33	..	..
Redruth	Literary Institute	Manley, Rev. W. L.	Grylls, Wm. M.	Phillips, William	..	10	10	..	1	2	..	..
Ripon	York and Ripon Training School.	Hedley, Rev. T.	Ward, Rev. J. M.	Taylor, Miss A.	..	35	35	..	..	7	..	..
Rochdale	Lyceum, Baillie Street	Robinson, John	Belmont, Edw.	Tomkins, E. Bahin, C. P.	..	47	47	..	..	18	..	..
Royton	St. Paul's National School	Whitaker, Robert	Hill, Rev. Rich.	Taylor, William	..	54	54	..	..	8	..	..
St. Helen's	St. Thomas's School	Mocatta, Rev. W. A.	Menzies, W. J.	Bournes, Thomas	19	23	4	..	1	4	..	..
St. Just	The Institution	Pochin, H. D.	Boyns, R.	Oats, F.	25	14	..	11	7	..	1 G.	..
Salford	Working Men's College	Boyns, R.	Plant, John	Lightbown, J. H. Monks, P. Law, E. Almgill, T.	44	53	9	..	6	11	..	..
"	St. John's Hall	Mather, J. W. D.	Richardson, Geo.	Tomkins, Edw.	20	24	4	..	7	11	..	..
Saltley	Training College	Smythe, P. M.	Smith, Rev. F.	Draper, Rev. J. B. Haworth, Rev. T. J. Basset, F.	..	20	20	..	..	37	..	..
Shrewsbury	Working Men's Hall	Sandford, H.	Phillips, T.	Sparkes, A. L.	..	45	45	..	..	..	..	..
Slough	Mechanics' Institution	Simpson, Rev. R. J.	Chapman, Jas.	Dorrell, John	62	22	..	40	4	4	..	..
Southampton	Hartley Institution	Mayes, E.	Le Feuvre, J. E.	Bond, F. T. Ranken, F. Edmonds, F.	..	40	49	..	..	1	..	..
Southminster	National School-house	Berkeley, Rev. G. C.	Berkeley, Robt. M.	Fleming, John	..	21	21	..	..	2	..	..
Southport	The Church Institute	Clarke, Rev. T. J.	Hatch, John	Bournes, Thos.	..	19	19	..	..	2	..	..
Stockport	Mechanics' Institution	Heginbotham, Hy.	Stockdale, Robt.	Gee, Wm. Davenport, T. Davies, G. W. Goodwin, J. W.	39	45	6	..	15	18	..	..
"	Sunday School, Duke Street	Leigh, James	Hill, Josiah	Davenport, Thos.	..	18	18	..	..	5	..	..
Stratford	Working Men's Hall and Club	Ram, Rev. A. J.	Mackey, Geo.	Swiss, Hy. Phillips, T. W. Smith, H. H.	..	58	58	..	..	37	..	..
Stroud	Stroud Institute	Dickinson, S.	Gardner, H. F.	Vick, W.	63	29	..	34	12	11	1 G.	..
Swansea	Royal Institution	Wilson, Chas. T.	Wilks, A. Platt	Molison, A. R.	..	45	45	..	..	4	..	..
Tavistock	British School	Daw, C. H.	Luxton, R.	Moffatt, Wm.	..	50	50	..	..	22	..	..
"	Gulworthy School	Mitchell, Rev. J. B.	Phillips, Wm.	Evers, Henry	..	34	34	..	..	9	..	1 B.
Tebworth	Wesleyan Day School	Seccombe, Rev. W.	Gurney, Nath.	Mackrell, I.	12	13	1	..	1	3	..	..
Thorne	Brookes' Grammar School	Jannings, Rev. Geo.	Lister, William	Constable, John	..	17	17	..	..	5	..	..
Torquay	School of Science and Art	Sheppard, A. G. R.	Strong, Rev. C. E.	Viccars, Thomas	36	63	27	..	13	28	..	1 B.
Ulverstone	Temperance Hall	Fell, John	Barber, Hy.	Prosser, W.	..	18	18	..	..	2	..	..
Walsall	Grammar School	Jesson, R.	Harrison, A.	Packer, M. W.	31	24	..	7	..	..	..	..
Warrington	Museum and Library	Beamont, Wm.	Webster, Geo. W.	Bournes, Thos.	..	102	102	..	..	6	..	..
Wellingborough	Lower Grammar School	Broughton, Rev. H. V.	Roxby, Rev. H. M.	Sturgess, W.	..	30	30	..	..	12	..	..
Werneth	Mechanics' Institute	Milnes, Thos.	Chadderton, F. H.	Mellor, J.	..	33	33	..	..	14	..	..
Whaleybridge	Mechanics' Institute	Kirk, James	Colles, A. H.	Hurst, W.	..	19	19	..	..	2	..	..

List of Science Schools and Classes, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1867.	1868.	Increase.	Decrease.	Number of Prizes. 1867.	1868.	Number of Medals. 1867.	1868.
Wigan	Mining and Mech. School	Fergie, Rev. T. P.	Peace, M. W.	Betley, R. Percy, C. McL.	23	71	48	..	9	17	..	1 B.
Wisbech	St. Peter's	Scott, Rev. John	Balding, A.	Miller, Saml. H.	..	24	24	..	..	7	..	..
Wolverhampton	Athenæum Class	Iles, Rev. J. H.	Langley, J. N.	Packer, M. W. Horton, F. C. Booth, E.	12	12	..	..	1	13	..	..
"	St. Peter's	Iles, Rev. J. H.	Langley, J. N.	Horton, F. C.	..	38	38	..	..	..	..	..
"	St. John's	Hampton, Rev. Hy.	Jordan, Joseph	Board, George	..	4	4	..	..	..	..	..
"	St. Luke's	Parry, Rev. J.	Wilkes, Martin	Breakwell, Wm.	..		8	..	..	1	..	..
Wolverton	Science and Art School	Mumford, A. L.	Meadley, J.	Harnett, Rev. F. W. Burgess, Rev. S. Davison, W. Nicholls, T. Moore, Wm.	60	65	5	..	35	18	..	..
Woolwich	Royal Arsenal Science Classes	Anderson, John	Keeble, W. D.	Noble, John Clarke, John Jas. Jones, T. Duckett, W. Brown, L. Jones, E. S. L. Gardner, C. R. Bradbury, A. A.	60	144	84	..	48	44	..	1 B.
"	National School	Brown, Rev. Hy.	Harrison, Rev. F. S.	Farlie, C. J. Swiss, Hy.	58	40	..	18	40	33	..	..
"	St. Thomas' Parochial School	Robertson, Capt. R., R.N.	Norman, Jas. H.	Busbridge, W. Downar, G. F. Gough, W. G. Charlesworth, T.	65	95	30	..	57	72	1 G., 1 B.	1 B.
"	Western District National School.	Baker, Rev. H. R.	Ruegg, Louis J.	Byatt, Horace	..	15	15	..	..	13	..	..
"	Presbyterian Schools	Thompson, Rev. W. M.	Ronald, H.	Jones, Thos. Duckett, W. Griffiths, J. A. Bradbury, A. A. Brown, L.	..	98	98	..	..	8	..	..
Worcester	Guildhall	Webb, William	Day, Harry	Ewens, F. T.	..	71	71	..	..	19	..	..
Yarmouth, Great	Navigation School	Worship, W.	Bracey, J.	Stockton, W.	112	81	..	31	1	1	..	..
York	Popular Institution	Palmer, Rev. H. V.	Hall, Robert	Hewison, Rev. G. H. Robinson, E.	120	80	..	40	3	6	..	..

SCOTLAND.

Aberdeen	Mechanics' Institution	Matthews, J.	Sinclair, Jas.	Beveridge, R.; Maver, D.	60	61	..	8	6	3	..	..
"	Navigation School	Rose, Wm.	Kellas, Jas. F.	Jones, J. R.	254	317	63	..	..	..	..	..
Banchory	Lady Burnett's School	Hutchison, Rev. G.	Stewart, J.	Ritchie, George	..	13	13	..	..	6	..	..
Beith	Presbyterian School	Muir, W.	Kerr, J.	Cook, W.	..	7	7	..	..	..	..	..
Corsock	Girls' School	Sturrock, Rev. G.	Martin, Thos.	Macomish, Miss M.	26	13	..	13	3	4	..	..
Dumbarton	Burgh Academy	M'Neil, Thos.	Babtie, John	Dickie, Hugh, and assistants.	..	12	12	..	..	..	..	..
Dundee	High School	Thoms, Wm.	Cumming, A. W.	Kennedy, John	57	70	13	..	14	6	..	1 G., 1 B.
Glasgow	Secular School	The Lord Provost of Glasgow	Cunliff, R. S.; Lang, Gilbert	Mayer, J.; Mayer, E.; Lochore, J.	163	80	..	83	52	22	..	..
" †	Andersonian University	" "	"	Herschel, A. S.; Buchanan, Geo.; Penny, Fredk.; Hennedy, R.	827	730	..	97	23	33	..	1 B.
	Mechanics' Institution	" "	"	Holmes, J.	..	950	950	..	..	5	..	1 S.
Inverness	School of Science and Art	Dallas, W.	Galloway, Geo.	Bain, Robt. L.; Robertson, G. W.	20	27	7	..	8	3	..	..
Kilmarnock	New Public School	Aitken, Rev. J.	MacKay, John	Stevenson, James; Dunn, Hugh S.	48	76	28	..	12	14	..	..
Kirkwall	Grammar School	Robinson, J.	Heddle, P. S.	Watson, J.	..	10	10	..	..	..	..	..
Leith	Navigation School	Watt, James	Thomson, Rev. John.	Bolam, James	200	228	28	..	5	..	..	..
Newhills	Free Church School-room	Smith, Rev. Jas.	Black, George	Ritchie, George	..	17	17	..	..	5	..	..
Tarbat	Parochial School	Campbell, Rev. G.	Mackie, Jas.	Fraser, Rev. D.	..	16	16	..	..	1	..	..

IRELAND.

Antrim	Main Street	Massareene, The Viscount.	Wilson, D. M.	Savage, H.; Speers.	43	66	23	..	6	14	..	..
Armagh	Natural History Society's House.	Lynne, J. M.	Davidson, B. P.	MacMillen, Robert	21	13	..	8	7	4	..	..
Athlone	St. Mary's School	Handcock, R. J,	Berry, Rev. E. F.	James, Matthew H.	28	37	9	..	7	16	..	2 B.
"	Ranelagh School	Handcock, R. J.	Berry, Rev. E. F.	Cavanagh, J.; Byrne, Jas.	..	32	32	..	..	35	..	..
Bagenalstown	National School	Morrin, Rev. P.	Fleming, Rev. Jas.	Fitzgerald, Edwd.	..	39	39	..	..	7	..	..
Bailieboro'	Model National School	Dalton, Major G. T.	Simpson, A. J.	Doherty, J. J.	86	84	..	2	34	38	..	1 G., 1 S.
Ballyboley	National School	Hall, Rev. Wm.	Gilmore, Rev. A. G.	Clements, Wm. T.	..	34	34	..	..	7	..	..
Ballycarry	Model School	Dalway, M. R.	Smiley, Alex.	M'Giffin, Robt.; M'Connell, F.	7	24	17	..	2	7	..	..
Ballymena	Model School	Rowan, Rev. R. W.	Given, John	Shannon, A. F.	28	13	..	10	5	4	..	..

† Out of the 1,680 students at these two Schools, only 117 applied for examination in May 1868.

List of Science Schools and Classes, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1867.	Number of Individuals under Instruction. 1868.	Increase.	Decrease.	Number of Prizes. 1867.	Number of Prizes. 1868.	Number of Medals. 1867.	Number of Medals. 1868.
Ballywilly	National School	Irwin, Rev. J.	MacShane, Rev. C.	Lee, Henry	..	19	19	..	..	..	..	..
Banbridge	Scarva Street National School.	Anderson, Rev. R.	Noble, John	Gillespie, Jas.	28	64	36	..	4	15	..	..
Belfast	Model National School	Taylor, Daniel	Shepherd, W.	Smeeth, R.	35	28	..	7	8	10	1 B.	..
"	Fisherwick Place	Taylor, Daniel	Shepherd, W.	Cleeland, R.; Elliott, T.	28	83	55	..	14	18	1 S.	1 B.
"	Academy Street	Lytle, John	Hanna, Rev. Hugh.	Barbour, Saml.	20	13	..	7	..	7	..	..
"	Crumlin Road	Blaney, Rev. W.	Murphy, Hy.	Collins, Thos.	23	15	..	8	..	..	..	..
"	Maritime Model School	Alexander, N. B., Capt. R.N.	Molloy, John	Doran, Geo.	95	18	..	77	..	..	..	..
"	Model School	O'Callaghan, A.	Molloy, Jno.	Wren, E.	47	95	48	..	19	30	..	..
"	Hamilton Street	Morrison, Rev. A.	Murphy, Hy.	Cullen, Wm.	..	15	15	..	..	..	..	..
"	May Street	Morrison, Rev. A.	Murphy, Hy.	Cullen, Wm.	..	27	27	..	..	3	..	..
"	Milford Street	Blaney, Rev. W.	Murphy, Hy.	Collins, Thomas	..	35	35	..	..	4	..	..
"	Seamen's Friend Society School-room.	Corry, J. P.	Murphy, H.	Clements, A.	..	22	22	..	..	1	..	..
"	St. George's School	Taylor, D.	Shepherd, W.	Mac Millen, W.	..	25	25	..	..	8	..	..
"	Brown Square National Sch.	Taylor, D.	Shepherd, W.	Small, H.	..	17	17	..	..	..	..	..
"	Union Place	Taylor, D.	Pasley, D.	Stevenson, J. M'N.	..	12	12	..	..	..	..	..
"	Wolfhill Mill	Montgomery, J.	Orr, William	Barbour, Samuel	27	19	..	8	8	5	..	..
Bessbrook	The Schoolhouse	Lett, Rev. H. W.	Wonfor, W. J.	Lyons, Michael	..	21	21	..	..	2	..	..
Braidwater	National School	Rowan, Rev. R. W.	Lynch, Rev. J.	M'Cormick, J.; Black, R.	..	15	15	..	..	3	..	..
Carlow	Christian Brothers' School	O'Neill, Rev. B.	Hade, Arthur	Mayne, A. J.	18	21	3	..	..	1	..	..
Carninny	National School	Rowan, Rev. R. W.	Park, Rev. W.	Dunlop, Saml.	..	16	16	..	..	4	..	..
Carrickfergus	Model School	Birnie, T. M.	Pasley, D.	Stevenson, J. M'N.	54	42	..	12	23	16	..	..
Castleshane	School-house	Lucas, E. W.	Moore, J. D.	Todd, Joseph	27	16	..	11	6	10	..	..
Coleraine	Model National School	Bruce, Sir H. H.	Bole, Wm.	Bresland, James	..	60	60	..	..	14	..	..
Comber	No. 1 National School	Rogers, Rev. J.	Withers, Robt.	Leetch, J.; Watt, W. D.; Brown, W. J.	86	44	10	..	20	15	..	..
"	Smyth's National School	Rogers, Rev. J.				52					..	..
Cooraclare	National School	Quinlivan, Rev. M.	Hogan, Rev. T.	M'Dermott, Cornelius.	..	40	40	..	..	14	..	..
Cork	District Model School	Sheridan, J. E.	M'Cord, Rev. G.	Linehan, P.; Latchford, G. D.; O'Brien, Miss E. M.	46	65	19	..	14	34	..	1 B.
Crossgar	National School	Cleland, James	Thomson, Rev. John G.	Scott, Samuel	..	16	16	..	..	18	..	..

Downpatrick - -	Young Men's Christian Association.	Woodward, Very Rev. T.	Pilson, Conway	Watt, W. D. - -	..	20	20	..	..	8	..	..
Drogheda - -	St. Mary's National School -	Mathews, Jas. -	McGroovy, N. -	O'Shea, M. J. - -	20	20	3	..	7	2	1 S. 2 B.	..
Dublin - - -	Central Model School -	Sullivan, R. - -	Butler, Edwd. -	Joyce, P. W. - ; Smeeth, J. F. -	97	127	30	..	30	31	1 B.	..
" - - -	King's Hospital School -	Flynn, J. H. - -	Dobbin, Rev. W. H. P.	Macbeth, John -	..	43	43	..	..	6	..	..
" - - -	55, Aungier Street - -	West, Very Rev. J. -	Hackett, Rev. J. W.	Kilroe, J. R. - -	..	21	21	..	..	2	..	..
Dundalk - -	Free Library - - -	Byrne, Patrick J. -	Price, Rev. Newton -	Lyons, Michael - ; M'Ewen, Hugh - ; Heasley, Richard	28	62	34	..	46	52	..	1 G.
Eglish - - -	National School - -	Robinson, Rev. G. -	Jones, Rev. J. W.	Hyde, Samuel - -	..	51	51	..	..	5	..	..
Enniscorthy - -	Model School - - -	Craufield, Thos. G. -	Boland, Geo. E.	Kelly, Daniel - -	29	40	11	..	4	7	..	..
Enniskillen - -	Town Hall - - -	Greer, Rev. S. - -	Bagot, Edwd. -	Doogan, Patrick -	12	17	5	..	1	2	..	..
Fintona - - -	National School - -	Robinson, A. H. -	Adair, Saml. -	Kelly, Patrick - -	10	8	..	2	6	3	..	..
Galgorm - -	National School - -	Young, John -	Raphael, J., jun.	M'Ilroy, Hugh - ; M'Ilroy, Robert -	31	36	5	..	11	16	..	1 B.
Galway - - -	Model School - - -	Stephens, James -	Gordon, J. -	Moylan, J. - -	40	43	3	..	7	5	..	..
Garrison (Co. Fermanagh).	National School - -	Flewry, Rev. J. -	Connolly, Rev. F.	Magennis, Peter -	..	13	13	..	..	5	..	..
Gilford - - -	National School - -	M'Master, J. W. -	Kidd, Hugh -	Pattison, Thomas -	..	35	35	..	..	8	..	..
Holywood - -	Sullivan School - -	The Bishop of Down and Connor	Monck, C. E. B.	Speers, Adam - -	75	76	1	..	24	18	..	..
Kilkenny - -	District National Model School.	Blunden, Sir J. -	Montmorency, Rev. W. de.	Ryan, L. J. - -	59	46	..	13	16	9	1 G.	..
Larne - - -	North End National School	Morgan, Rev. T. P. -	Eccles, Wm. -	O'Neill, Samuel -	17	41	24	..	10	10	..	..
" - - -	Model Agricultural School -	Morgan, Rev. T. P. -	Eccles, Wm. -	Hay, William - -	24	49	25	..	14	15	..	..
Loughinisland -	National School - -	Crickard, Rev. J. -	Johnson, Patrick	Doran, Chas. - ; Nesbitt, John -	15	13	3	..	2	..	..	..
Lurgan - - -	National School - -	Hancock, John -	Roantree, D. J.	Small, Hugh - ; Greer, Alexander ; Mooney, Thomas - ; Porter, George -	58	61	3	..	8	18	..	..
Markethill - -	Coolmalish National School	O'Toole, Rev. D. -	Cuming, Wm. -	Lee, Henry - -	..	20	20	..	..	4	..	..
Monaghan - -	Church Education School -	Bailey, Rev. W. R. -	Eardley, Fras. -	Todd, Joseph - -	..	23	23	..	..	13	..	..
Newport Pratt -	Parochial School House -	Roe, Rev. W. D. -	Malley, Jno. A.	Baker, B. M. - -	..	7	7	..	..	1	..	..
Newry - - -	Model School - - -	Dodd, Rev. John -	Porter, David C.	M'Cullough, Hugh ; Leonard, Francis	..	41	41	..	..	..	..	..
Newtonbreda (near Belfast).	National School - -	Kennedy, James -	Workman, Rev. R.	Erwin, Moses - -	..	33	33	..	..	..	..	..
Newtownards -	Model School - -	Pooler, Rev. J. G. ; Moore, Rev. H. -	Macdonnell, Jas.	Harbison, M. - - ; Greer, W. H. - - ; Scott, Samuel -	109	134	25	..	52	50	1 S.	1 G., 1 S., 1 B.
" - - -	101, Church Street - -	Young, Rev. Jas. -	Macdonnell, Jas.	O'Reilly, John C. -								
Oldcastle - -	Endowed School - -	Durdin, Rev. J. G. -	O'Neill, Richard	Beatty, John - ; Smyth, Andrew -	160	190	30	..	65	40	..	1 S. 1 B.

List of Science Schools and Classes, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.	
					1867.	1868.			1867.	1868.	1867.	1868.
Portadown - -	National School - -	Shillington, T. A. -	Donnelly, Rev. Jas.	MacMillen, Robert -	18	30	12	..	17	9	..	..
Portlaw - - -	Science and Art School -	Martin, J. - -	Skellern, J. K. -	Cane, J. B. N. - -	..	9	9	..	..	..	..	..
Raphoe - - -	National School - -	Thomson, Rev. J. -	Wilson, Thomas	Cotter, Edw. G. -	9	18	9	..	1	10	..	..
Roscrea - - -	National School - -	Meagher, Rev. J. -	Brown, S. - -	Muldoon, C. - -	..	9	9	..	..	7	..	..
Santry - - -	Incorporated Society's Training School - -	West, Very Rev. J. -	Hackett, Rev. J. W. - -	Mayne, A. J. - - / Engledow, W. H.	60	60	..	..	44	87	1 S., 3 B.	1 S., 3 B.
Strabane (Co. Tyrone). - -	National School - -	Lyle, T. - - -	Nesbitt, R. -	Cotter, Edw. G. -	..	22	22	..	..	12	..	..
Tandragee - -	Male National School -	O'Brien, J. S. -	Bushe, Rev. J. P.	MacMillen, R. - -	..	34	34	..	..	..	..	..
Trim - - -	District Model School -	Lightburne, H. -	Conwell, E. A. -	Freehill, M. - -	72	62	..	10	15	28	..	..
Waterford - -	Model School - - -	Hoare, Very Rev. E. N.	Cavet, James -	Dowling, James -	28	55	27	..	2	8	..	..
Whitehouse - -	National School - -	Smythe, Rev. G. C. -	Aitken, James -	Keenan, Michael -	..	18	18	..	..	7	..	..
					9,281	15,010	5729		2,446	3,822		

TABLE showing the Number of STUDENTS under INSTRUCTION in the various SUBJECTS.

Table showing the Number of Students under Instruction in the various Subjects in May 1868.

Place and School.		No. of Individuals under Instruction in May.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction and Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Physiology and Economic Botany.	XVII. Systematic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
ENGLAND.																									
Abingdon - -	British School - -	46	..	..	..	..	..	..	..	..	..	4	..	..	..	42	..	..	..	..	..	..	..	..	..
Accrington - -	Mechanics' Institution -	29	..	..	..	..	..	..	..	..	13	27	..	..	..	22	..	..	..	..	..	..	..	..	..
Alderley Edge -	Day School-room - -	18	12	12	..	..	..	..	..	..	..	10	..	..	..	..	..	10	..	..	..	..	..	..	..
Almondbury -	Grammar School - -	26	..	..	..	..	..	..	..	..	..	26	..	..	..	..	..	..	..	..	..	..	..	..	..
Alnwick - -	Mechanical Institution -	28	..	..	..	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Andover - -	British School - -	39	..	..	..	..	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	39
Ashby-de-la-Zouch -	Mutual Improvement Society	19	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..	..	..	..	..	..
Ashton-under-Lyne	Mechanics' Institution	29	29	29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ -	Parish Church School -	15	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bacup - -	Mechanics' Institution -	42	21	21	7	..	..	..	..	..	12	9	3	..	..	..	..	..	..	..	..	..	..	..	..
Banbury - -	British School - -	48	..	..	..	14	..	..	..	..	..	..	..	..	..	..	34	..	..	..	..	..	..	..	38
Barnsley - -	Mechanics' Institution -	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bingley - -	Mechanics' Institute -	17	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..
Birmingham -	Midland Institute - -	152	..	..	..	46	..	..	28	33	..	122	..	9	..	..	..	10	10	..	..	..	..	..	22
„ -	St. Barnabas' School -	57	..	..	..	..	..	..	..	..	..	..	..	..	..	40	39	..	..	..	..	..	..	..	22
„ -	School of Art - - -	75	75	75	75	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ -	Bloomsbury Institution -	80	35	..	..	..	..	..	1	..	30	10	..	..	..	14	22	..	..	..	..	..	..	..	21
-	Clarendon Chambers -	11	..	..	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Birstall - -	Mechanics' Institution -	26	..	..	..	..	..	..	..	..	15	26	..	..	..	..	..	..	..	..	..	..	..	..	..
Blackburn - -	Mechanics' Institution -	16	..	..	..	..	..	..	..	..	..	16	..	..	..	12	..	..	..	..	..	..	..	..	..
„ - -	Wesleyan School - -	9	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Blandford - -	Working Men's Club -	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Bodmin - -	Literary Institution - -	31	..	..	..	..	..	..	..	7	17	..	..	..	..	22	..	..	..	..	..	..	..	..	3
Bolton - -	Science and Art School -	193	67	66	67	12	..	7	7	12	12	42	..	6	..	28	..	..	..	..	5	..	..	3	23
„ - -	Mechanics' Institution -	67	65	66	64	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Breage, Cornwall -	Literary Institution -	23	..	..	..	..	..	..	..	..	..	23	..	..	23	..	..	..	..	..	..	..	..	..	..

Brimscombe	Reading Room	17	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..
Bristol	Bristol Trade School	145	75	83	68	78	..	73	57	..	74	92	92	..	..	..	..	..	..	6	..	..	..	..	..
Bromsgrove	Literary and Mechanics' Institution.	26	..	..	..	..	..	..	..	..	..	..	..	..	..	26	..	..	..	..	..	..	..	..	..
Burnley	Literary Institution	58	25	25	..	..	..	..	..	4	10	6	..	..	..	5	..	..	..	..	..	..	..	..	39
"	Mechanics' Institution	48	..	..	..	..	..	..	..	5	..	12	..	..	..	13	..	..	..	..	..	..	..	..	34
"	Westgate School	21	..	..	..	..	..	..	..	21	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..
"	Carlton Road	61	..	..	..	..	..	..	..	..	..	47	..	..	..	31	..	..	..	..	..	..	..	..	..
"	Grammar School	40	..	..	..	..	..	..	..	..	..	40	..	18	..	..	..	..	..	..	..	..	..	..	..
Bury	Athenæum	79	77	72	60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Camborne	British School	24	..	..	..	..	..	..	..	..	..	24	..	..	24	..	..	..	..	..	..	..	..	..	..
Canning Town	Holy Trinity School	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cardiff	Free Library	63	15	38	39	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chatham	St. Mary's	40	40	40	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Mark's, New Brompton	27	27	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cheltenham	Bedford Buildings	212	..	..	..	20	..	58	58	20	21	13	13	1	..	16	61	..	16	..	17	..	..	..	16
Chester	Mechanics' Institute	30	23	20	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chorley	National School	20	6	6	8	13	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cold Norton	National School	13	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Compstall	Athenæum	27	27	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Congleton	Wesleyan School	13	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Cradley	School Street	6	..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..
Crewe	Mechanics' Institution	44	11	43	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Croydon	Literary Institution	32	32	32	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Culham	Training College	27	..	..	..	..	..	2	..	..	..	16	..	..	..	18	..	..	..	..	..	..	..	..	..
Darlington	Mechanics' Institution	13	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..
Dartford	Working Men's Institution	36	36	36	36	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dartmouth	Mutual Improvement Society.	26	2	..	2	..	..	..	..	23	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Darwen	Mechanics' Institution	14	..	..	..	..	..	..	..	..	..	13	..	..	..	14	..	..	..	..	..	..	..	..	..
Denton	Mechanics' Institution	33	20	21	21	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21
Deptford	St Paul's	21	21	21	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Christ Church	27	27	..	..	..	..	..	..	27	..	..	..	..	..	27	..	..	..	..	..	..	..	..	..
Derby	Grammar School	12	..	..	..	..	..	..	..	..	..	12	..	..	..	12	..	..	..	..	..	..	..	..	..
Dewsbury	Mechanics' Institution	17	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..
Droylsden	Educational Institution	58	53	53	53	..	..	..	..	..	..	9	9	..	..	..	..	..	..	..	..	..	..	..	..
Durham	Training College	29	..	..	..	3	..	..	..	..	..	..	..	..	..	29	..	..	..	..	..	..	..	..	..
Eagley	Institution	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	31
Earlstown	District School-room	17	17	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Eastington	National School	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
East Retford	National School	55	..	..	..	55	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Eastwood	Mechanics' Institution	18	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Elland	Mechanics' Institution	22	..	..	..	..	..	..	..	..	11	17	..	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Number of Students under Instruction in the various Subjects, &c.—*continued.*

Place and School.		No. of Individuals under Instruction in May, 1868.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction and Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Physiology and Economic Botany.	XVII. Systematic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Exeter - -	10, Bedford Circus - -	32	..	..	..	10	..	..	..	..	..	6	..	5	..	7	..	12	12	..	..	..	..	..	..
Failsworth - -	Mechanics' Institution -	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Falmouth - -	National School - -	14	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..
Gateshead - -	National School - -	39	2	30	2	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gloucester - -	Blue-coat School - -	44	..	..	..	34	..	..	..	..	44	34	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Free Library - - -	34	..	..	..	14	..	6	6	..	..	15	15	..	..	..	..	..	..	..	..	..	..	..	..
Greenwich - -	Literary Institution - -	42	42	42	42	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	12
" - -	Girls' National School -	20	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Halifax - -	Working Men's College -	35	..	..	..	..	..	..	..	..	10	34	10	..	..	..	..	..	..	..	..	..	..	..	..
Haslingden - -	The Institution - -	18	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	16
Heywood - -	Mechanics' Institution -	44	30	35	30	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..
Hollinwood - -	Working Men's Club and Institute.	31	17	17	17	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Huddersfield -	Mechanics' Institution -	23	..	..	..	..	..	..	..	..	..	23	..	..	..	..	..	..	..	..	..	..	..	..	..
Hull - -	Nautical School - -	80	..	..	..	61	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	72	65	71	80
Huntingdon -	Walden's School - -	16	..	..	..	..	..	..	..	4	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..
Hyde - -	Mechanics' Institution -	41	18	18	3	..	..	12	6	14	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..
Kettering - -	National School - -	52	..	..	..	..	..	..	..	..	..	..	..	..	..	52	..	..	..	..	..	..	..	..	..
Kingsbridge -	Town Hall - - -	17	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..	10	..	..	..	..	..	..	..
Kinver - -	National School - -	25	..	..	..	..	..	..	..	..	..	15	..	..	..	15	..	..	..	..	..	..	..	..	..
Lancaster - -	Mechanics' Institution -	48	..	..	..	..	..	..	..	..	..	35	..	8	..	28	..	..	..	..	..	..	..	..	..
Leeds - -	Mechanics' Institution -	47	..	..	..	..	..	..	..	..	..	41	6	..	..	..	..	..	..	..	..	..	..	..	..

Leeds	Parish Church School	83	83	17	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Leicester	St. Martin's	53	..	..	..	32	..	..	..	..	21	18	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Portland Street	5	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Limehouse	St. Anne's	24	24	..	..	..	..	..	..	24	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..
Liverpool	Free Library	60	..	..	..	..	..	16	..	..	26	30	..	..	..	9	9	17	..	..	..	..	..	..	..
"	Institution	107	..	..	..	107	..	..	..	..	..	83	..	..	..	..	..	..	..	..	..	..	..	..	..
Llanelly	Copper Works School	73	1	35	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	23
London:—																									
Bath Street	City Middle Class School	42	36	10	37	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Battersea	Training College	80	..	..	..	80	..	..	..	..	..	..	..	..	..	44	..	..	..	..	..	..	..	..	42
"	Sir Walter St. John's School	53	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	53
Bermondsey	Christ Church Schools	22	22	22	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bethnal Green	Birkbeck School	106	..	..	..	..	..	..	..	..	74	..	..	..	..	74	80	..	..	..	..	..	..	..	74
"	National Schools	115	..	..	..	21	..	..	12	6	75	..	..	76	..	..	..	10	..	..	..	..	..	..	58
Brixton Hill	Workmen's Hall	9	9	9	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chelsea	St. Mark's College	48	..	..	..	48	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	48
"	Literary Institution†	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Luke's	153	..	110	110	..	..	..	76	..	52	50	..	..	..	53	..	..	..	..	..	..	..	..	..
"	Royal Military Asylum	11	..	..	..	11	1	9	..	9	..	11	..	..	..	..	..	..	..	..	..	..	..	..	11
*Dock Street	Navigation School	328	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	328	328	..	..
Great Ormond St.	Working Men's College	15	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..
Hackney	St. Thomas' Square	48	..	..	..	..	..	..	..	..	..	..	..	..	..	48	..	..	..	..	..	..	..	..	..
Islington	Lower Islington Public School.	145	1	24	1	2	..	..	..	..	80	90	..	..	..	60	4	62	12	..	..	..	..	..	60
Knightsbridge	Albert Working Men's Club†	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lambeth	Hercules Buildings	155	40	155	155	..	..	..	..	..	..	..	..	84	..	..	84	..	..	..	..	..	..	..	60
Leadenhall Street	City of London College	30	..	5	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	9	..	..	..	..
Marylebone	Central Schools	48	..	..	48	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Paddington	Greville House	31	31	31	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Peckham	Upper and Middle Schools	362	..	..	..	231	..	90	..	89	..	..	..	..	..	..	40	..	..	..	..	..	..	..	113
Regent Street	Royal Polytechnic Institution.	46	..	..	..	..	..	..	..	..	18	28	..	..	..	12	..	..	..	..	..	..	..	..	..
Southwark	Boro' Road Training College	69	..	..	..	69	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Waterloo Road	St. John's School	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
West Brompton	Edith Grove School-room †	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Westminster	Wesleyan Training College	29	..	..	..	8	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	29
Whitechapel	Society's Schools	27	27	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Macclesfield	Modern Free School	43	..	..	..	..	..	..	..	..	..	43	..	..	..	..	..	..	..	..	..	..	..	..	..
Maldon	Mechanics' Institution	12	..	..	..	..	..	..	..	7	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..
Manchester	Mechanics' Institution	200	116	100	80	12	..	24	24	40	40	120	..	..	..	120	..	1	1	1	40	..	..	10	60
"	Roby Society	39	20	23	..	..	..	..	..	..	..	7	..	7	..	..	..	..	..	..	..	..	..	..	..
"	Corporation Street	41	..	..	..	..	..	..	..	..	..	41	19	..	..	..	..	..	..	..	..	..	..	..	..
"	Ardwick	28	20	20	20	..	..	..	..	..	..	12	..	..	..	12	..	..	..	..	..	..	..	..	..
"	Hulme W. M. I.	31	9	9	..	..	..	..	..	..	..	15	12	..	..	4	..	6	..	..	..	..	..	..	..

† Included with St. Luke's, Chelsea.

Table showing the Number of Students under Instruction in the various Subjects, &c.—*continued.*

Place and School.		No. of Individuals under Instruction in May, 1868.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction and Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Physiology and Economic Botany.	XVII. Systematic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Manchester	St. George's	12	11	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. John Baptist	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Melton Mowbray	Church School Room	8	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..
Middlesborough	Church of England Institution.	11	..	..	..	..	..	..	..	..	8	11	..	..	..	..	..	..	..	..	..	..	..	..	..
Middleton	National School	22	..	..	..	..	..	..	..	8	..	..	..	..	..	22	..	..	..	..	..	..	..	..	..
Modbury	Mechanics' Institution	10	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..
Mossley	Mechanics' Institution	23	23	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nelson-in-Marsden	Lomeshaye	36	..	..	..	..	..	..	..	36	7	..	10	29	..	..	..	..	..	..	..	..	..	..	..
Newark	Mechanics' Institution	34	..	..	..	..	..	..	..	22	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
New Mills	Mechanics' Institution	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Newton Heath	All Saints	18	..	..	..	..	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..
Northampton	Guildhall	115	..	..	..	..	..	..	..	..	115	..	..	..	..	..	..	..	..	..	..	..	..	..	..
North Ormesby	Church Institute	7	..	..	..	..	..	..	..	..	7	7	..	..	..	..	..	..	..	..	7	..	..	..	..
Nottingham	Trinity School	61	..	..	..	..	..	..	..	..	..	21	..	10	..	34	..	..	..	..	..	..	..	..	..
Oldbury	National School	61	..	..	..	..	..	..	..	..	..	..	..	..	..	61	..	..	..	..	..	..	..	..	..
"	Messrs. Chance's School	14	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..
Oldham	Science and Art School	80	59	62	20	16	..	16	13	..	..	2	..	..	..	..	..	5	..	..	..	..	..	..	..
"	Glodwick	30	30	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Analytic Institution	44	31	29	5	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Parish Church School	33	33	30	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Temperance Seminary	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Padiham	National School	10	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..
Patricroft	Mechanics' Institution	27	27	27	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pendleton	Mechanics' Institution	20	..	14	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Penzance	School of Art	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Plumstead	Burrage Road	57	57	57	57	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Plymouth	Science School	163	22	..	20	40	4	5	15	30	..	34	5	..	..	5	..	6	6	..	..	1	1	26	52
"	Buckwell Street	13	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Navigation School	344	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	340	340	..	..
*Pontypridd	Science School	13	..	..	..	..	..	..	..	..	..	8	..	9	..	7	..	..	..	..	..	..	..	..	..
Portland	Grove School	30	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Preston	Institution	57	25	25	25	9	..	7	..	..	..	30	..	..	..	12	..	..	..	..	..	..	..	..	..
Purleigh	National School	24	..	..	..	..	..	..	..	6	9	..	..	..	..	10	..	..	..	..	..	..	..	..	17
Ramsbottom	Public Institution	17	17	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rawtenstall	Mechanics' Institution	55	55	55	55	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Redruth	Literary Institution	10	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..
Ripon	York and Ripon Training School.	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	35
Rochdale	Lyceum	47	38	38	28	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..
Royton	St. Paul's	54	54	34	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
St. Helen's	St. Thomas' School	23	..	..	..	..	..	..	..	..	..	23	..	..	..	..	..	..	..	..	..	..	..	..	..
St. Just	Institution	14	..	..	..	..	..	..	..	..	..	14	..	..	14	..	..	..	..	..	..	..	..	..	..
Salford	Working Men's College	53	32	23	11	..	..	..	..	..	..	10	10	..	..	..	..	..	..	..	..	..	..	..	11
"	St. John's Hall	24	24	23	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Saltley	Training College	20	4	..	..	17	..	4	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	13
Shrewsbury	Working Men's Hall	45	..	..	..	13	..	1	..	4	..	42	..	..	1	..	..	..	..	..	..	..	..	..	1
Slough	Mechanics' Institution	22	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Southampton	Hartley Institution	49	9	11	..	9	9	..	..	20	24	15	..	..	..	..	..	..	..	..	..	..	..	..	..
Southminster	National School	21	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Southport	Church Institute	19	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..	..	..	..	..	..
Stockport	Mechanics' Institution	45	19	22	22	..	..	15	6	15	10	..	..	..	..	10	..	..	..	..	..	..	..	..	..
"	Sunday School	18	18	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stratford	Working Men's Club	58	58	58	58	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stroud	Institute	29	..	..	..	..	..	..	..	..	..	15	..	14	..	..	..	..	..	..	..	..	..	..	..
Swansea	Royal Institution	45	..	..	..	..	..	45	45	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tavistock	British School	50	..	..	..	..	..	..	..	30	24	..	..	..	..	25	..	..	..	..	..	..	..	..	..
"	Gulworthy School	34	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30
Tebworth	Wesleyan Day School	13	..	..	..	..	..	..	..	..	1	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Thorne	Grammar School	17	13	5	6	7	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Torquay	School of Science and Art	63	..	..	..	..	..	..	..	15	..	..	..	..	..	55	..	..	..	..	..	..	..	..	..
Ulverstone	Temperance Hall	18	..	..	..	..	..	..	..	..	..	13	..	..	..	10	..	..	..	..	..	..	..	..	.
Walsall	Grammar School	24	..	..	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..
Warrington	Museum and Library	102	..	..	..	..	..	..	..	..	..	102	..	..	..	..	..	..	..	..	..	..	..	..	..
Wellingborough	Grammar School	30	..	..	..	..	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..
Werneth	Mechanics' Institution	33	33	33	33	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Whaleybridge	Mechanics' Institution	19	17	17	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Number of Students under Instruction in the various Subjects, &c.—*continued*,

Place and School.		No. of Individuals under Instruction in May 1868.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction and Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Physiology and Economic Botany.	XVII. Systematic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Wigan	Mining and Mechanical School.	71	36	36	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	29	..	..	..	..	..
Wisbech	Working Men's Institute	24	..	..	..	..	..	..	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..
Wolverhampton	Athenæum	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Luke's	8	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Peter's	38	..	..	..	..	..	..	..	..	..	..	..	..	..	38	..	..	..	..	..	..	..	..	..
"	St. John's	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4
Wolverton	Science and Art School	65	29	29	..	24	..	..	..	10	10	..	..	..	..	15	..	..	..	..	..	..	..	..	..
Woolwich	Royal Arsenal	144	56	56	56	55	..	..	..	..	17	26	..	..	..	..	..	..	..	..	..	..	..	..	18
"	National School	40	40	40	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Western District	15	15	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Thomas' School	95	82	81	81	..	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..
"	Presbyterian Schools	98	..	53	53	..	..	..	..	..	..	..	..	96	..	..	..	..	..	..	..	..	..	..	..
Worcester	Guildhall	71	..	..	..	..	..	..	..	8	10	..	..	..	..	61	..	..	..	..	..	..	..	..	..
Yarmouth, Gt.	Navigation School	81	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	81	39	..	..
York	Popular Institution	80	48	..	..	24	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	15
						SCOTLAND.																			
Aberdeen	Mechanics' Institution	61	..	..	..	58	..	46	..	..	..	..	..	..	..	3	..	4	6	..	..	..	..	..	..
"	Navigation School	317	..	..	..	56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	285	274	..	..
Banchory	Lady Burnett's School	13	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Beith	Presbyterian School	7	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Corsock	Girls' School	18	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	2	..	..	..	..	..	..	..
Dumbarton	Burgh Academy	12	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dundee	High School	70	70	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Glasgow	Secular School	80	..	..	..	..	..	..	..	..	..	..	..	..	..	..	70	60	..	..	..	30	..	..	..	60
"	Andersonian University } †	1080	..	..	..	..	..	..	..	..	157	..	450	450	..	..	250	..	108	108	..	..	..	..	..	..
"	Mechanics' Institution }		..	90	..	..	..	..	..	16	..	..	60	..	..	..	..	..	..	..	..	..	..	..	..	..
Inverness	School of Science and Art	27	15	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kilmarnock	New Public School	76	18	42	..	37	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kirkwall	Grammar School	10	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Leith	Navigation School	228	..	..	..	75	..	0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	194	169	32	..
Newhills	Free Church School	17	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tarbat	Parochial School	16	..	..	..	8	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	6	..	..	6
IRELAND.																										
Antrim	Main Street	66	..	..	..	..	..	..	..	..	50	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..
Armagh	Natural History Society's House.	13	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	4
Athlone	St. Mary's	37	..	..	..	..	..	..	..	..	37	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Ranelagh School	32	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21	..	..	30
Bagenalstown	National School	39	1	..	..	39	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballieboro'	Model National School	84	..	..	..	..	..	..	..	..	84	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballyboley	National School	34	..	..	..	..	..	..	..	..	..	34	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballycarry	Model Agr. School	24	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	18	..	..	6
Ballymena	Model School	18	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	18
Ballywilly	National School	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	19
Banbridge	Scarva Street	64	..	..	..	..	..	..	..	..	51	..	..	..	..	..	..	..	..	..	..	..	..	..	..	22
Belfast	Model School	95	..	..	..	29	..	31	..	..	31	86	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Fisherwick Place	83	..	..	..	27	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	53
"	Academy Street	13	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Crumlin Road	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15
"	Maritime Model School	18	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Model School	28	28	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Hamilton Street	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15
"	May Street	27	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..	12
"	Milford Street	35	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
"	Seamen's Friend Society	22	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21	..	..	..
"	St. George's School	25	..	..	..	8	..	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	17
"	Brown Square	17	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Union Place	12	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10	3	..	5
"	Wolfhill Mill	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	19
Bessbrook	School House	21	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

† Of these only 117 applied for examination.

Table showing the Number of Students under Instruction in the various Subjects, &c.—*continued*.

Place and School.		No. of Individuals under Instruction in May 1868.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction and Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Physiology and Economic Botany.	XVII. Systematic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Braidwater -	National School -	15	..	..	..	..	..	..	..	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Carlow -	Christian Brothers' School -	21	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Carninny -	National School -	16	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Carrickfergus -	Model School -	42	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13	7	..	30
Castleshane -	School House -	16	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Coleraine -	Model National School -	60	..	..	..	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	60
Comber -	Smyth's National School -	52	..	..	..	..	..	..	..	52	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	No. 1, National School -	44	..	..	..	19	..	..	..	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cooraclare -	National School -	40	..	..	..	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cork -	District Model School -	65	..	..	..	..	..	..	..	12	..	..	..	..	..	..	53	..	..	..	..	10	..	..	..
Crossgar -	National School -	16	..	..	..	12	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16
Downpatrick -	Young Men's Christian Association.	20	..	..	..	..	..	..	..	19	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Drogheda -	St. Mary's National School -	29	20	..	..	..	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..	..
Dublin -	Central Model School -	127	32	..	..	..	..	..	..	..	104	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	King's Hospital School -	43	..	..	..	43	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	43
" -	Aungier Street -	21	..	..	..	20	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Dundalk -	Free Library -	62	..	..	..	49	..	18	..	16	15	..	..	..	..	..	..	..	..	..	..	19	..	..	28
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Galway -	Model School -	43	..	..	..	22	..	9	..	..	37	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Garrison	National School	13	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gilford	National School	35	..	..	..	..	..	..	..	..	35	..	..	..	..	..	..	..	..	..	..	..	..	..	8
Holywood	Sullivan's School	76	..	..	..	..	..	..	..	72	..	..	..	..	..	..	..	..	..	..	..	..	..	..	56
Kilkenny	Model School	46	..	..	..	15	..	..	..	45	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Larne	North End National School	41	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	41	..	..	..
"	Model Agricultural School	49	..	..	..	34	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	24	..	..	27
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Lurgan	National School	61	..	..	..	24	..	..	..	..	61	..	..	..	..	..	..	..	..	..	..	..	..	..	50
Markethill	Coolmalish National School	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Monaghan	Church Educational School	23	..	..	..	..	..	..	..	..	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Newport Pratt	Parish School House	7	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Newry	Model School	41	..	21	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	19
Newtownbreda	National School	33	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	33
Newtownards "	Model School 101, Church Street	134	..	..	..	64	..	..	..	..	23	..	..	6	..	113	..	..	..	..	..	..	..	..	107
Oldcastle	Endowed School	190	..	..	..	2	..	..	..	..	96	..	..	..	..	..	..	..	..	..	..	..	..	..	94
Portadown	National School	30	..	..	..	20	..	6	6	24	6	..	..	..	..	..	..	..	..	..	..	..	..	..	10
Portlaw	Science and Art School	9	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	9	9	..	..	..	..	..	..
Raphoe	National School	18	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Roscrea	National School	9	..	..	..	9	..	9	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9
Santry	Training School	60	15	6	6	60	20	40	30	54	54	..	..	6	..	..	6	40	40	..	..	19	19	54	40
Strabane	National School	22	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15
Tandragee	Male National School	34	..	..	..	9	..	..	..	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	27
Trim	District Model School	62	..	..	..	..	..	..	..	..	..	..	..	62	..	..	..	..	..	..	..	..	..	..	..
Waterford	Model School	55	..	..	..	..	..	..	..	..	..	55	..	..	..	..	..	..	..	..	..	..	..	..	..
Whitehouse	National School	18	..	..	..	18	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Totals	15,010	2,827	2,862	2,135	2294	34	677	421	1496	1764	2632	654	513	62	1999	510	312	220	36	108	1513	1215	196	2404

Schools marked with an * are Navigation Schools not examined in May 1868.

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SCIENCE DIRECTORY,

Showing the Nature and Amount of Assistance afforded by and through the Science and Art Department to Instruction in Science.

[The Rules in the present Edition supersede those in all former Editions, but are always subject to Revision. *Important Alterations made since the last edition of the Directory are printed in Italics.*]

Parliamentary vote.

A sum of money is voted annually by Parliament for scientific instruction in the United Kingdom, and is administered by the Science and Art Department.

Heads of the Department.

The head of the Education Department, of which the Science and Art Department is a branch, is the Lord President of the Council, assisted by a member of the Privy Council, who is called the Vice-President of the Committee on Education, and who acts under the direction of the Lord President, and for him in his absence. (Order in Council, 25th February 1856, Act 19 & 20 Vict. c. 116.)

Object of the grant.

The object of the grant is to promote instruction in Science especially among the industrial classes, by affording a limited and partial aid or stimulus towards the founding and maintenance of Science schools and classes.

Grant liable to be withdrawn.

The amount is liable to be decreased and eventually withdrawn. Payments to teachers therefore must not be looked upon as perpetual, or in any way conferring on the teacher a claim to any payments beyond those offered for each current year.

Payment of Fees by Students.

The payment of fees by the students can be looked upon as the only solid and sufficient basis on which a self-supporting system can be established

and supported. Though my Lords do not consider it necessary at present to lay down any rules making the payment of fees an absolute condition of the grants on account of Science instruction, yet as the payments from the State must be expected to diminish, and as aid on account of those persons who do nothing for themselves cannot be justified, Committees of schools and classes and teachers are strongly urged (should it at present not be the practice) at once to impose as high a scale of fees as they consider can be raised not only on middle class students but also on artisans.

The following is a general outline of the action of the Department for the benefit of those who wish to establish a Science School or Class. At p. 10 will be found the detailed rules and regulations under which the aid of the Department is administered.

Summary of the Aid Granted by the Science and Art Department to Science Schools and Classes.

Local committees.

1. In order to place a Science school or class in connexion with the Department, an approved committee, consisting of at least five well-known and responsible persons must be formed. (*See* Rules IV. and V., pp. 11 and 12.)

Subjects of instruction.

2. The list of Science subjects towards instruction in which aid is given by the Department will be found at p. 10.

Nature of aid.

3. The aid is given in the form of—

a. Public examinations, in which Queen's Medals and Queen's Prizes are awarded, held at all places complying with certain conditions.

b. Payments on results as tested by examination.

c. Scholarships and exhibitions.

d. Building grants.

e. Grants towards the purchase of apparatus, &c.

f. Certain supplementary grants.

4. The Examinations are held in May by the local committees. The examination papers are prepared by the professional examiners in London, and are sent to the local secretaries; one evening is set apart for each subject, so that the examination in each subject is simultaneous over the whole kingdom. (*See* Rule X., p. 14.) Examinations, when held.

5. The examinations are of two kinds, but held together (*See* Rule XI., p. 14.), viz.: Class examinations.

a. The class examinations, of which there are two grades or stages; the first stage or elementary examination, and the second stage or advanced examination. Those successful in the elementary stage are divided into 1st, 2nd, and 3rd class, and those successful in the advanced stage into 1st and 2nd class.

b. The honours examination, of a highly advanced character. For Honours.

Any person however taught may sit at any one of these examinations. (*See* Rule XIX., p. 16.)

6. Four medals, one gold, one silver, and two bronze, are given in each subject in competition in the class examinations among the students. (*See* Rule XXI., p. 17.) Medals.

7. Queen's prizes consisting of books or instruments are also given to all candidates successful in obtaining a first class in either stage of the class examinations. (*See* Rule XX., p. 17.) Prizes.

8. Payments are made to the Committees or to the teachers on the results of the May examination. Any person may qualify himself or herself to earn payments on results: Payments on Results.

a. By obtaining a first or second class in the advanced grade of the class examination, or Qualification.

b. by taking honours.

This examination is dispensed with when the candidate has taken a degree at one of the Universities of the United Kingdom. (*See* Rule XXII., p. 17.)

9. Payments are made only on account of the instruction of students of the artisan and industrial Amount of payment.

classes, or on account of the instruction of their children. (*See* Rule XXV., p. 19.) The payments claimable for each such student in each subject are—3*l.* for a first class in the elementary stage, 2*l.* for a second class, and 1*l.* for a third class; and, after a student has passed in the first stage, a further payment of 4*l.*, 3*l.*, or 2*l.* (according to his previous success in the elementary stage) for a first class, and of 3*l.*, 2*l.*, or 1*l.* for a second class in the advanced stage. (*See* Rules XXVI. and XXVII., p. 19.) The total amounts claimable are reduced in the case of previous successes and according to a certain scale when the amount exceeds 60*l.* (*See* Rule XXVIII., p. 20.)

Condition.

10. The teacher must have given each student 25 lessons at least, and payments on results are made either directly to the teachers or to the committee of the school. (*See* Rules XXIII. and XXIV., p. 18.)

Scholarships.

11. There are two forms of scholarship in connexion with elementary schools.

Elementary school scholarship.

a. In the Elementary School Scholarship 5*l.* are granted to the managers of any elementary school for the support of a deserving pupil selected by competition, if they undertake to support him for a year and subscribe 5*l.* for that purpose. The payment of 5*l.* by the Science and Art Department is conditional on the scholar passing in some branch of science at the May examination. (*See* Rules XXXVII. and XXXVIII., p. 23.)

Science and Art scholarship.

b. The *Science and Art Scholarship* is of a more advanced character. A similar contribution of 5*l.* is required on the part of the locality. A grant of 10*l.* is made by the Department towards the maintenance, for one year, of the most deserving pupil or pupils in elementary schools who have passed certain examinations in science and in drawing. (*See* Rules XL. and XLI., p. 24.)

In both these cases the scholar must be from 12 to 16 years of age, and one scholarship is allowed per 100 pupils in the school.

12. The Exhibitions are:— **Exhibitions.**

a. Local Exhibitions to enable students to complete their education at some college or school where scientific instruction of an advanced character may be obtained. Grants of 25*l*. per annum, for one, two, or three years are made for this purpose when the locality raises a like sum by voluntary subscriptions. And if the student attend a State school, such as the Royal School of Mines in London, the Royal College of Chemistry in London, or Royal College of Science in Ireland, the fees are remitted. The exhibition must be awarded in competition. (*See* Rules XLV. and XLVI., pp. 25 and 26.) **Local exhibition.**

b. Royal Exhibitions of the value of 50*l*. per annum tenable for three years, to the Royal School of Mines, London, and the Royal College of Science, Dublin, are given in competition at the May examinations. Six are awarded each year—three to each institution. Free admissions are also given to all gold medallists. (*See* Rules XLVIII. to LII., p. 27.) **Royal exhibition.**

13. Besides these, the Whitworth Scholarships of the value of 100*l*. per annum, tenable for two or three years, are also given in competition at the May examinations. (*See* Rule LIII., p. 27.) **Whitworth Scholarships.**

14. A grant in aid of a new building, or for the adaptation of an existing building, for a School of Science may be made at a rate not existing 2*s*. 6*d*. per square foot of internal area, up to a maximum of 500*l*. for any one school, provided that certain conditions are complied with and that the school— **Building grant.**

a. be built under the Public Libraries and Museums Act; or—

b. be built in connexion with a School of Art, aided by a Department building grant.

(*See* Rule LIV., p. 28.)

15. A grant towards the purchase of apparatus, diagrams, &c., of 50 per cent. of the cost of them is made to Science Schools. (*See* Rule LV., p. 28.) **Apparatus grant.**

DETAILED REGULATIONS UNDER WHICH SCIENCE SCHOOLS AND CLASSES ARE ADMINISTERED.

List of Science subjects.

I. The following are the Sciences towards instruction in which aid is given:—

Subject 1, Practical Plane and Solid Geometry.
,, 2, Machine Construction and Drawing.
,, 3, Building Construction *or* Naval Architecture and Drawing.
,, 4, Elementary Mathematics.
,, 5, Higher Mathematics.
,, 6, Theoretical Mechanics.
,, 7, Applied Mechanics.
,, 8, Acoustics, Light, and Heat.
,, 9, Magnetism and Electricity.
,, 10, Inorganic Chemistry.
,, 11, Organic Chemistry.
,, 12, Geology.
,, 13, Mineralogy.
,, 14, Animal Physiology.
,, 15, Zoology.*
,, 16, Vegetable Anatomy and Physiology.
,, 17, Systematic and Economic Botany.
,, 18, Principles of Mining.
,, 19, Metallurgy.
,, 20, Navigation.
,, 21, Nautical Astronomy.
,, 22, Steam.
,, 23, Physical Geography.

Nature of assistance.

II. The assistance granted by the Science and Art Department is in the form of—

1. Public examinations, in which Queen's Medals and Queen's Prizes are awarded, held at all places complying with certain conditions.
2. Payments on results to Committees or teachers.
3. Scholarships and Exhibitions.

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* No candidate will be passed in Zoology unless at the same or at a previous examination he has passed in the elementary stage of Animal Physiology. (*See* Syllabus, p. 118.)

4. Building Grants.
5. Grants towards the purchase of apparatus, &c.
6. Supplementary grants in certain subjects, and special aid to teachers and students.

NOTE.—*As respects all grants and awards, the Department will be the sole judge, and cannot enter into correspondence respecting its decisions.*

III. Suitable premises, with firing, lighting, &c., must be found and maintained at the cost of the locality where the school or class is held. If at any time the funds do not cover these requisite local expenses, it must be inferred that there is no such demand for instruction in the locality as the Government is justified in aiding; and the assistance of the Department will be withdrawn. School Premises.

A school or class receiving aid from the Science and Art Department must be at all times open to the visit and inspection of its officers; if at any time it is found that the apparatus, examples, &c., towards the purchase of which a grant has been made is not properly taken care of, or that a proper room with firing, lighting, &c. is not provided for the class, the aid of the Department will be withdrawn.

IV. Every Science School or Class must be under the management of a Local Committee who are required to be responsible for the safe custody of all apparatus, towards the purchase of which the Department has granted aid, and to conduct the examinations according to the rules. (*See* Science Form, No. 91, p. 47.) Constitution of Local Committee.

The relation of the teacher to the Committee of a school or class will vary much according to the varying circumstances of different localities. With this and other local arrangements the Science and Art Department does not interfere, but leaves them to the locality to settle.

a. The Committee must consist of a Chairman, Secretary, and at least three other members, and must be composed entirely of well-known responsible persons of independent position who have no such personal interest in the school or class as can lay them open to the slightest

suspicion of partiality. Relations and pupils of the Teacher, persons under instruction in any school or class receiving aid from the Science and Art Department, and teachers of any description having pupils who are candidates for the examinations of the Department, are not eligible as members of the Committee.

NOTE.—A gentleman whose son attends any examination of the Science and Art Department is thereby disqualified from superintending any of the examinations that year, though he may act on the Committee in other respects.

b. It is very desirable that as many persons as possible in recognised positions of public responsibility in the district, such as magistrates, municipal authorities (mayor, aldermen, or town councillors), heads of educational establishments (trustees of grammar schools, managers of National schools), clergymen, &c., should be on the Committee, and it is *absolutely necessary* that at least two such responsible persons should agree to act.

c. The Chairman must be a magistrate, mayor, boroughreeve, provost, or alderman, or other public officer of recognised position, trustee of grammar school, or clergyman of the Established Church in parochial employment. He will have to certify that the constitution of the Committee is in accordance with the above requirements. (*See* Science Form, No. 88, p. 37.)

d. The Secretary of the Committee of the School or Class, as being the medium of communication, will carry on all correspondence with the Science and Art Department, and is held responsible for making out and sending all returns required, for the receipt and distribution of the examination papers, the transmission of the worked papers, &c., at the proper times according to the regulations.

Formation of Local Committee.

V. The gentlemen who intend to act on this Committee must sign their names to a form (*write for* Science Forms, Nos. 88 and 120), stating their willingness to carry out the necessary arrangements for examinations, and to observe all the regulations of the Department; each member after signing must also give his address and occupation. Care must be taken that the members who sign are properly acquainted with the duties they propose to discharge.

When a school or class is first formed, the Form No. 88 must be signed at a general meeting of the Committee. If the same Committee continue to act it will only be necessary to fill up Form No. 168, which expresses the willingness of the members to undertake their duties for another

year; but no one can be a member of a Committee nor assist in the conduct of an examination who has not signed Form No. 88.

VI. As soon as a school or class has been established and the Committee formed, application must be made that it may be approved by the Department (*send up* Science Forms Nos. 88 and 120). No payments on account of instruction will be made unless this approval has been obtained before the 31st January preceding the examination. **Approval of, by the Department.**

When a Committee has been formed for conducting an examination only, or for the management of a class or school not receiving aid from the Department (*write for* Science Form No. 88*a*) it must be approved before the 31st March.

VII. For the clerical labour of making the necessary returns, filling up forms, &c., my Lords have sanctioned a grant to the Committee of 1*l., which will be paid after the conclusion of the examinations.* **Reimbursement of Committee.**

When more than two examinations are held the sum of 10*s. will be allowed to the Committee for each further examination for the expenses connected with it.*

These grants will only be made provided the examinations are regularly conducted, and the returns and forms sent up in due course, as given on the Science Form No. 170. (See *p.* 36.)

VIII. As often as may be necessary an Inspector of the Department will visit the school or class, and will report to my Lords on the condition of the premises, the constitution of the Committee, and the manner in which the regulations are carried out. **Inspection.**

If due notice of the visit of the Inspector has been given, a meeting of the Committee must be held to receive him, at which as many of the members as possible are expected to attend. (*See* Science Form No. 170, p. 36.)

IX. At page 36 will be found a table of memoranda for the use of Secretaries and Members of Science Committees (*write for* Science Form No. 170) *which it is expected will be carefully attended to.* **Memoranda for Secretaries.**

Examinations.

Examination of Classes.

X. The Science and Art Department holds annually about May, through the agency of the Local Committees, public examinations in all the before-mentioned Sciences in any place in the United Kingdom which complies with the requisite conditions. (*See* Rule IV., p. 11.)

XI. The examinations are of two kinds, but are held on the same evening and conducted by the same Committee:—

a. The class examinations for students under instruction in Science Classes whether taught by teachers qualified to earn payments on results or not.

b. The honours examination, of a highly advanced character.

The class examination is of two grades or stages; the first stage or elementary examination, and the second stage or advanced examination. On this examination the payments on results and prizes, &c. are awarded as specified in Rules XX. and XXI., p. 17, and Rules XXVII. and XXVIII., pp. 19 and 20.

Classification of Results of examinations.

XII. At the class examinations the grades of success are:—in the first or elementary stage, first, second, and third class; and in the second or advanced stage, first and second class. For the third or lowest class the standard of attainment is only such as will justify the Examiner in reporting that the instruction has been sound, and that the students have benefited by it; but the standard may be raised from year to year.

In the examination for honours, the grades of success are first and second class.

Application for Examination.

XIII. An application, stating in what subjects examination will be required, must be made on Science Form No. 329, *and sent in before the* 28*th of February. A second form (Science Form No.* 119) *must be sent in before the* 31*st of March, giving the precise number of candidates to be examined in each subject.*

On the 31st of March the examination lists must be finally closed, and unless these instructions have been **strictly** *adhered to no examination can be held.*

The rules for the conduct of the examinations will be found on Science Form No. 91, (see *p.* 47). *They must be carried out with the utmost strictness.*

XIV. Should there be at any time reason to suspect the fairness of the examination generally, or of the way in which particular candidates have worked their papers, a further examination will take place in such manner as may be deemed most advisable. Refusal on the part of any candidate to answer will entail the cancelling of his previous examination. **Re-examination.**

XV. All possible care will be taken by the Department at the time of the examinations that papers may be forwarded in accordance with the applications, and that the results may be correctly issued. As, however, a very large number of classes have to be dealt with, mistakes may possibly occur. The Department cannot undertake to rectify such mistakes, nor will it hold itself responsible for any loss which may in consequence accrue to individual committees, teachers, or students. ***Department not responsible for errors.***

XVI. If two or more classes in the same town, or within a reasonable distance of one another, apply for the examination of the Science and Art Department, a general examination committee must be formed by the amalgamation of the several Committees to carry out the examinations at some common centre, such as the town hall or other public building. It is only when the Inspector reports that the local circumstances are of such a character as to render an amalgamation of the Committees impracticable that it will not be insisted on. ***Amalgamation of Classes and Committees.***

When there are not more than three candidates in one place, it will be at the discretion of the Department to allow a separate examination, or to require the candidates to go to a neighbouring centre.

XVII. In large towns or populous districts where there are three or more schools, and where numerous ***Special Local Secretary.***

examinations are to be held, my Lords may at their discretion require a Special Local Secretary to be appointed to manage the whole of the examination business, and will correspond with him alone on all subjects connected with the examination. He will be allowed a fee of ten guineas, and an extra fee of half a guinea for each night that an examination is held.

The rule requiring an amalgamated examination to be held in some one public building (see *Rule XVI.*) *will be adhered to also in this case. Even where no sufficiently large public building can be obtained, or where there may be other insuperable difficulties to holding the examinations at one centre, the one Special Local Secretary must still be the one medium of communication with the Department, and will be responsible for all arrangements subject to the approval of the Science and Art Department.*

Election of Special Local Secretary.

XVIII. The election of the Special Local Secretary will rest with the Local Committees; or failing their coming to an agreement he will be nominated by the Mayor or other principal municipal authority.

The Special Local Secretary will be nominated for the approval of my Lords from year to year, before the 15*th of March.*

Examination of external Students.

XIX. Besides the registered students of a class, any other person may present himself for examination before the Local Committee whenever an examination is being held for the class. *Before the* 26*th of March he must apply to a Local Secretary, who will forward his name to the Department on Science Form No.* 119, and if required by the Local Committee he will have to pay a registration fee of not more than 2*s*. 6*d*. Arrangements must therefore be made by the Local Committee, or the General Examination Committee, as the case may be, to give accommodation at the examination to all outside candidates *who have given the proper notice*, as well as to the students in the class for which the Committee act, to sit at the examination.

The registration fee of 2*s*. 6*d*., which such candidates may be required to pay, is to reimburse the Committee for any extra expenses incurred by such attendance, and may at their option be remitted.

XX. To all successful students are given printed lists of results showing their position; to the first class in both stages are given Queen's prizes, consisting of books or instruments chosen by the candidates from lists furnished for that purpose. (*Apply for* Science Form No. 110.) **Queen's Prizes.**

The prizes are unlimited in number, and are open to all candidates who come within either of the following categories:—

(1) Students in Science Classes under Teachers qualified to earn payment.

(2) Registered Students in Artisan Classes taught by other Teachers.

Other Candidates, if successful, only receive Cards of merit.

The following are not eligible for prizes:—

a. Teachers earning or who have earned payments on the results of instruction; and

b. Students who have previously received the same, or a higher class, in the same subject. Also

c. Persons who are or have been students of the Queen's Colleges in Ireland, the Royal School of Mines, London, the Royal College of Science, Dublin, the Royal Dockyard Schools, and other institutions receiving State aid for instruction may compete for the Whitworth and other Exhibitions and Scholarships of the Department, but they cannot take Queen's prizes and medals, except in those subjects which are not taught in the Institutions to which they belong.

XXI. Four medals, one gold, one silver, and two bronze, are given in the class examination in each subject for competition among the bonâ fide students of Science Classes who either come within the category of persons on account of whom payments can be earned, or are under 17 years of age. **Queen's Medals.**

Only registered students of schools and classes under Local Committees (*see* Rule IV., p. 11) can take medals: middle class students, persons engaged in teaching, who are more than 17 years of age, as well as *teachers in training*, even if qualified as above, are ineligible for them. Should a student take more than one gold, silver, or bronze medal, he will receive books instead.

PAYMENTS ON RESULTS.

XXII. Payments are made on the results of instruction given by persons who have:— **Qualification.**

a. obtained certificates as teachers in any of the before-mentioned sciences according to the rules in force previous to January 1867; or,

b. obtained a First or Second Class in the advanced paper at the May class examination since that date; or,

c. taken honours at the May examination.

No payments are made on account of instruction given in subjects in which the teacher is not so qualified.

The examination will be dispensed with in the case of a candidate who has taken a degree at any University of the United Kingdom, or who has obtained the Associateship of the Royal School of Mines, London, or the Royal College of Science, Ireland. *Before such a candidate commences to teach in order to earn payment on results he must make formal application to the Department to be recognised as a Science teacher, and he must furnish full particulars of his occupation and position accompanied by his diploma or a certificate from the registrar of his University.*

To whom made.

XXIII. Payments on results are made either directly to teachers or to the Committee or managers of the school. Where classes are formed by a teacher incidentally, in addition to his regular duties, the payment may be made directly to him. Where there is a regularly organised Science School, with day, or day and evening classes in science, the payments will be made to the Committee. The question of a school claiming under this last head will be specially considered by the Department.

Conditions.

XXIV. Payments are only made to the teacher or to the Committee on condition that the student has received 25 lessons at least from the teacher or teachers in each subject in which payment is claimed since the last examination, each lesson being an attendance at a meeting of the school of at least three-quarters of an hour's duration on a separate day. The 25 lessons need not necessarily be all given in one year, but may extend over a longer period.

It must be clearly understood that the number (25) of lessons which the teacher is required to give is the minimum

fixed as a criterion that the pupil has received his instruction from the teacher. It is not meant in any way to specify that that amount of instruction is sufficient, or to guarantee the teacher's receiving payment, if that amount of instruction alone is given.

XXV. Payments are made to the qualified teacher on account of the instruction of students of the Industrial Classes only. **Payments to Teachers.**

Under "Students of the Industrial Classes" are included only :—

a. Artisans or operatives in the receipt of weekly wages.

b. Coastguards, policemen, and others who, though in receipt of weekly wages, do not support themselves by manual labour.

c. Persons in the receipt of salaries not large enough to render them liable to the income tax, as some descriptions of clerks, shopmen, &c.

d. Small shopkeepers employing no one but members of their own family and not assessed to the income tax.

e. Tradesmen and manufacturers on their own account, supporting themselves by their own manual labour, not employing apprentices, journeymen, &c., and not assessed to the income tax.

f. The children (not gaining their own livelihood) of all such persons above-mentioned.

XXVI. The payments claimable for each student who has passed the first or elementary stage, in each subject are—3*l*. for a first class, 2*l*. for a second class, and 1*l*. for a third class. **Payments in the Elementary Stage.**

But if the student has been previously successful in the same stage of the same subject, the payments are reduced by the normal payment which was claimable on such previous success.

For instance, the 2*l*. payment for a second class in the first stage would, if the student had previously taken a third class, be reduced by 1*l*.

Deductions will be made in payments on account of Subject I. to the amount of any payments that have been made on Second Grade Examinations in Art, in practical geometry, perspective or mechanical drawing.

XXVII. Further payments are claimable for each student who passes in each subject in the advanced stage, provided such student has already in a previous year passed in the same subject in the ele- **Payments in the Advanced Stage.**

mentary stage * on the following scale: for a second class 3*l*., 2*l*., or 1*l*., according as the highest success of the student has been third, second, or first class of the elementary stage; for a first class 4*l*., 3*l*., or 2*l*. according as his highest success has been third, second, or first class of the elementary stage. If the student have already passed second class in the advanced stage of any subject then only 1*l*. in addition can be claimed on his behalf should he pass first class in the same stage.

The general object of this rule will be seen to be that on a student eventually passing in the first class of the advanced stage 5*l*. will, on the whole, have been claimable on account of his instruction.

The rule will be modified in the case of teachers who, at the Examination in May 1870, *are bonâ fide passing for and intend at once to become Science Teachers. The proviso that the student shall first pass in the elementary stage before passing in the advanced will not be obligatory in their case, and the Science Teacher who has instructed them will be allowed to earn full payment on their account —up to a maximum that is of* 5*l*. *for a first class in the advanced stage.*

Reductions.

XXVIII. The total amount paid to each teacher is subject to the following deduction; when on this scale it would amount to more than 60*l*. the excess up to 40*l*. is diminished by one quarter, the excess above 40*l*. by one half.

Thus a total payment which on the above scale would be 100*l*., or 60*l*.+40*l*., will be reduced to 60*l*.+40*l*.—¼ of 40*l*., or 90*l*. Again, where the total sum claimed amounts to 150*l*., *i.e.*, 60*l*.+40*l*.+50*l*., the payment made will be 60*l*.+40*l*.—¼ of 40*l*.+50*l*.—½ of 50*l*.=60*l*.+30*l*.+25*l*.= 115*l*.

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* Students who have already passed at any examination before that of the year 1869 are considered as satisfying this condition, and payments will be made on their account according to the old rules, on the assumption that the First and Second Class in the advanced stage represent the former first and second class, and that the first, second, and third class in the elementary stage represent the former third, fourth, and fifth class. Thus if a student who has already taken a fourth class should at the next examination take a second class in the advanced stage, the teacher will receive 2*l*. on his account.

If the teacher be instructing classes three miles or more apart this deduction will be reduced by the amount of his travelling expenses. This amount should be inserted on the claim for payment (*see* Science Form No. 51, p. 44) and certified by the Committee.

XXIX. Payments are made to the Committees on the same scale as that given in Rule XXVII., with the exception of the reductions described in the last paragraph (Rule XXVIII.) which do not apply, but no payment of more than 15*l.* will be made on account of any one student, nor will the total payment to the school exceed a maximum of 2*l.* per successful paper worked at the examination by artisan students taught during the preceding year. **Payments to Committee.**

These payments may be divided in any proportion the Committee think fit among the teachers of the school, and a proportion not exceeding 20 per cent., nor exceeding the local voluntary contribution to the expenses of the school, may be deducted by the Committee in aid of such expenses.

XXX. The claim for the payments must be made on Science Form No. 51. The voucher must be signed by the secretary or chairman and two members of the Committee at least, at a meeting of the Committee held specially for the examination and certification of the claim. (*See* Science Form No. 51, page 43.) **Form of Claim for Payment.**

XXXI. A general register must be kept for the school, and an attendance register for each class in each subject, on Forms which will be supplied on application. (*Apply for* Science Forms Nos. 139 and 139A.) These registers must be made up from day to day, and will be examined and approved by the Inspector on his visit. They must be sent to the Department with the claim for payment, and no grants will be made unless the registers are properly kept. **Registers.**

a. The Committee must keep a General Register (Science Form No. 139) of all the pupils attending the Science Classes under their supervision, in which the name, age, address, and occupation of each student must be entered. This register must be filled in by the Secretary or a member of the Committee, and not by the teacher.

b. For every class the teacher must keep a register of attendance (Science Form No. 139A), in which he will enter

the presence or absence of the students at each lesson. The Committee is held responsible for the entries being correct.

c. A register must also be kept of the attendance of the members of the Committee at their different meetings. (*See* page 8 of Science Form No. 139.)

Instruction in Elementary School.

XXXII. All payments to qualified teachers on account of Science teaching are made by the Science and Art Department, and are only made in respect of a school in connexion with the Science and Art Department. No such payments are made in respect of any instruction in Science that may be given during the three attendances of an Elementary School receiving aid from the Educational Department, Whitehall.

Use of Elementary School premises.

These grants are only made while the teacher is giving instruction in a day or evening school or class for the industrial classes (adults or boys), approved by the Science and Art Department, and open at any time to the visit and inspection of its officers. The managers of an Elementary School under the inspection of the Education Department can permit their premises to be used for Science teaching, provided that no interference be allowed with the primary purposes of such Elementary School, or in any way with the three attendances of the Elementary School.

Instruction in Institutions receiving State aid.

XXXIII. No payments on the results of instruction in those branches of Science which are taught in Institutions receiving State Grants, such as the Queen's Colleges in Ireland, the Royal School of Mines, London, the Royal College of Science, Dublin, and the Royal Dockyard Schools, will be made on account of the pupils who are or have been students of those institutions.

Examination by the Inspector.

XXXIV. On the occasion of his periodical visit to the school or class, the Inspector will inquire and see how the instruction is being given, examining the pupils, if necessary, vivâ voce, *and report if there is sufficient apparatus for the satisfactory teaching of experimental science. If the Inspector's report of any school shows that the instruction is inefficient, and that from the deficiency of proper apparatus, &c.,*

it cannot be otherwise, my Lords reserve to themselves the power of refusing to make payments on the results of the examinations.

Scholarships and Exhibitions.

XXXV. In order to assist members of the artisan and industrial classes who may show an aptitude for scientific instruction, the Science and Art Department makes grants to aid local efforts in founding scholarships and exhibitions. The scholarship is intended to maintain the student while remaining at the elementary school, and the exhibition to support him while pursuing his studies at some central institution where the instruction is of a high grade. Scholarships and Exhibitions.

XXXVI. There are two forms of local scholarship in connection with elementary schools:— Local Scholarships.

(1.) The Elementary School Scholarship;
(2.) The Science and Art Scholarship.

By elementary school is understood any school where elementary instruction is given, whether aided by the State or not.

XXXVII. *Elementary School Scholarship.*—The Science and Art Department will make a grant of 5*l.* towards the maintenance of a deserving student to the managers of any elementary school who undertake to support him for one year and subscribe also at least 5*l.* for that purpose. Elementary School Scholarships.

XXXVIII. *Conditions.*— Conditions of obtaining the Elementary School Scholarships.

a. With any number of scholars up to 100 on the register of the school there can be but one such Scholarship; above 100 and up to 200 two Scholarships, and so on for each 100.

b. The Scholarship or Scholarships must be awarded in competition to the most successful student or students in some examination of the school. The absolute terms of the competition and the award of the Scholarship will be left to the managers of the school, subject to the approval of the Science and Art Department.

c. The scholar must be an artisan or poor student as defined above (*see* Rule XXV., p. 19), and be between 12 and 16 years of age.

d. He must not be the teacher, pupil-teacher, or other paid servant of a school.

e. He must continue regularly to attend the day school, and—

f. Obtain at least a third class in the elementary stage in some one or more branches of Science at the succeeding May examination of the Science and Art Department, after which the Department grant of 5*l.* will be paid.

Date of application and of grant.

XXXIX. Application must be made for the Elementary School Scholarship before the 1st March in one year, and the Department grant will be paid after the May examination in the next year. (Apply for *Science Forms Nos.* 280, 281, 282.)

Science and Art Scholarship.

XL. *The Science and Art Scholarship.*—The Science and Art Department will make a grant of 10*l.* towards the maintenance of a student at an elementary school who has taken a first grade in Freehand or Model Drawing and Elementry Geometry (*see* Art Directory, p. 16), and passed in one of the subjects of Science, *provided that the managers of the school undertake to support him for one year and subscribe 5l. for that purpose.*

The examination in drawing can, where there is no Art Certificated Teacher, be held by the Science Class Committee, to whom the necessary papers will be sent.

Conditions of obtaining the Science and Art Scholarship.

XLI. *Conditions.*—

a. With any number of scholars up to 100 on the register of the school there can be but one such Scholarship; above 100 and up to 200 two Scholarships, and so on for each 100 scholars.

b. The Scholarship or Scholarships will be awarded to the most successful student or students in the school.

c. The scholar must be an artisan or poor student as defined above (*see* Rule XXV., p. 19), of between 12 and 16 years of age.

d. He must not be the holder of an Elementary School Scholarship, the teacher, pupil-teacher, or other paid servant of a school.

e. He must continue regularly to attend the day school, and—

f. Obtain a higher class in the subject of Science in which he has already passed, or pass in some other subject.

g. In each year of holding the Scholarship he must pass either in a higher grade of the same subject or in a new subject.

XLII. Application for the Science and Art Scholarship must be made before the 1*st March in one year; the successful competitors for the scholarship will be decided at the May examinations of that year, and the Department grant of* 10*l. will be paid after the May examination in the next year.* (Apply for *Science Forms Nos.* 283, 284, 285.) *Date of application and of grant.*

XLIII. These grants will be made from year to year on the condition that the student each year pass in a new subject, or in a higher grade of the same subject in which he first passed. It will be for the locality to determine for how many years the student may hold the scholarship, but in no case can he be allowed to hold it for more than three years. Conditions of renewal of grants for Scholarships.

XLIV. For advanced scientific instruction, the Department offers exhibitions to enable students to complete their education at some college or school where scientific instruction of an advanced character may be obtained. These exhibitions are of two kinds:— Exhibitions.

(1.) The Local Exhibition.
(2.) The Royal Exhibition.

XLV. *Local Exhibitions.*—The Science and Art Department will make a grant of 25*l.* per annum to the Managers of any school or educational institution, or any Local Committee formed for the purpose, who will raise the like sum by voluntary con- Local Exhibition.

tribution for the maintenance of a student at some college or school where scientific instruction of an advanced character may be obtained. The exhibition may last for one, two, or three years.

Conditions of obtaining it.

XLVI. *Conditions.*—

a. The exhibition must be awarded in competition in one or more branches of Science at the May examination of the Science and Art Department. The managers may select any branch or branches of Science for the competition, and if more than one be taken they may fix any relative amount of marks they consider best to assign to them.

b. The place or places where the exhibition is to be tenable and where the student is to pursue his studies may be fixed by the managers subject to the approval of the Science and Art Department, provided that the exhibitioner shall always have the option of going to one of the following institutions :—The Royal School of Mines or Royal College of Chemistry, London, or the Royal College of Science, Dublin. If either of the Government institutions be selected, the fees of the student will be remitted.

c. The exhibitioner must be of the artisan class or a poor student, as defined above (*see* Rule XXV., p. 19).

d. The grant of the Department will be paid from year to year on condition that a like payment has been made by the managers or Local Committee, and that the student has pursued his studies satisfactorily according to regulations fixed by the Department.

Date of application.

XLVII. The Local Exhibition must be applied for before the 1*st March*. (Write for *Science Forms Nos.* 286, 287, 288.)

Thus, for example, a Local Exhibition which is to be competed for in May 1875 *must be applied for before the* 1*st March* 1875, *and the Department grant will be given after the May examinations in* 1876.

XLVIII. Royal Exhibitions, of the value of 50*l.* per annum tenable for three years, to the Royal School of Mines, London, and the Royal College of Science, Dublin, are given in competition at the May examinations. Royal Exhibitions.

XLIX. There are nine Royal Exhibitions to the Royal School of Mines, Jermyn Street, and nine to the Royal College of Science, Dublin, of the value of 50*l.* per annum each, entitling the holders to free admissions to all the lectures, and to the Chemical and Metallurgical Laboratories at those two institutions. They can be held from year to year for three years, on the condition that the holder attends the lectures regularly during those years, and passes the examinations required for the associateship of the school. Conditions of holding them.

L. Generally there will be six of the above Royal Exhibitions, viz., three to the Royal School of Mines, and three to the Royal College of Science, open for competition at the May examinations, independently of the prizes, &c. offered by the Science and Art Department. Competition for at May examination.

LI. All persons over 21 years of age, excepting artisans, and such as come within the category of persons paid upon under Rule XXV. (*see* p. 19), will be excluded from competing for the Royal Exhibitions. Special cases, however, must be determined according to the spirit of the rules, and the object of the endowment. Persons not eligible for them.

LII. The competition for the Royal Exhibitions will be determined by affixing certain values to the several results of the May examination. Of this the details will be hereafter published. Competition for them.

But no candidate will be allowed to take an exhibition who has not shown a satisfactory knowledge of Mathematics equivalent to that required for a first class in the elementary stage of Elementary Mathematics.

LIII. Whitworth scholarships of the value of 100*l.* per annum, tenable for two or three years, are also given in competition at the May examinations. Whitworth Scholarships.

Full instructions as to the subjects, time, place, conditions, &c. of the competition for these scholarships are given in the **Whitworth Prospectus,** which can be had on application to the Secretary, Science and Art Department.

Building Grants.

Grants in aid of building Science Schools.

LIV. A grant in aid of a new building, or for the adaptation of an existing building, for a School of Science may be made at a rate not exceeding 2*s*. 6*d*. per square foot of internal area, up to a maximum of 500*l*. for any one school, provided that the school—

a. be built under the Public Libraries Act (13 & 14 Vict. c. 65.; 18 & 19 Vict. c. 70.; 29 & 30 Vict. c. 114.), (*see* Summary of the Law relating to the establishment and maintenance of Public Libraries, &c., p. 50); or—

b. be built in connexion with a School of Art aided by a Department building grant.

And provided that there is a population in the neighbourhood which requires a School of Science; that it is likely to be maintained in a state of efficiency; and that the site, plans, estimates, specifications, title, and trust deeds are satisfactory.

The regulations under which building grants to Schools of Science are made will be found at p. 52. (*Apply for* Science Form No. 349.)

Apparatus Grants.

Grants for Apparatus.

LV. A grant towards the purchase of apparatus, diagrams, &c., of 50 per cent. on the cost of them, is made to Science Schools and Classes taught by duly qualified teachers under the supervision of Committees constituted in accordance with the Rule IV., and approved by the Department.

Grants on the same scale will also be made to schools or classes not under qualified teachers in cases where the total value of the apparatus required is not above 10*l*.

LVI. As a general rule no endowed school is eligible to receive a grant towards the purchase of

apparatus, &c., unless considerable local contributions are made in aid of it; and then only when the apparatus is clearly necessary.

LVII. Catalogues containing priced lists of apparatus, instruments, diagrams, books, &c. from various manufacturers have been prepared in the following sciences and can be had on application :— Catalogues of apparatus.

(1.) Practical Geometry, Machine and Building Construction, and Mechanics.
(2.) Experimental Physics.
(3.) Chemistry.
(4.) Geology and Mineralogy, Natural History, (Physiology, Zoology, and Botany), and Physical Geography.

These catalogues contain the highest price of each article on which the aid of 50 per cent. is given. The applicant is at liberty to select a higher priced article, but the aid towards the purchase of it will be only 50 per cent. of the highest price above mentioned. Should a lower priced article be selected the aid will only be to the extent of 50 per cent. of its price.

Schools are also permitted to select a single copy of each of the text books given in the Syllabus, towards the purchase of which similar aid will be granted.

LVIII. Committees requiring aid in the purchase of apparatus, &c. should apply for Science Form No. 49, and also for the catalogues referred to in the previous rule. Method of obtaining grants.

The Committee of the School or class may select any of the manufacturers whose names are given in the catalogues.

Orders from different tradesmen must be made on separate forms.

In filling up the Form No. 49, the number of the apparatus given in the catalogue must always be mentioned.

LIX. Payments, including charge for packing, must be made in advance to the manufacturers on receipt of the invoice. The goods to be sent at the risk of the purchaser. On obtaining a receipt from the Committee of the School (which is included in the form of Requisition) that the articles have been received, the remaining 50 per cent. will be paid to the manufacturer by the Department. Payments to manufacturers.

Limitation of grants.

LX. Apparatus grants are rigorously confined to articles of a non-destructible nature; hence no aid will be afforded in the purchase of breakable articles, such as glass retorts, tests tubes, &c., or, indeed generally, in the purchase of articles to be used by the student, as distinguished from those of a permanent and illustrative character which are required by the Teacher in giving instruction in Science.

Grants are only made in the purchase of one object of the same kind. Duplicates of apparatus, &c. are not allowed at the reduced rate.

Supplementary Grants in certain Subjects, and Special Aid to Teachers and Students.

Navigation Schools.

LXI. In addition to the ordinary science examinations in May, class examinations are held in Mathematics, Navigation, Nautical Astronomy, Steam, and Physical Geography for the benefit of seafaring men—and for them only—three times a year in all seaports where Local Committees are formed and are willing to undertake them. These examinations take place in the beginning of March, September, and December. The application for these examinations must be made on Science Form No. 119 before the 10th day of the previous month.

The payments to properly qualified teachers (*see* Rule XXII., p. 17) on the results of the quarterly examinations for seamen, will be according to the same scale as that laid down for the ordinary May examinations (*see* Rules XXVII. and XXVIII., pp. 19 and 20), and the regulations with regard to Committees (*see* Rules IV. and V., pp. 11 and 12), registers (*see* Rule XXXI., p. 21), and number of lessons (*see* Rule XXIV., p. 18), must also be carried out in the case of Navigation Schools.

Payments to Art Teachers.

LXII. Teachers who, previously to the 28*th January* 1869, *have obtained Art Certificates of the* 3rd *grade* (see *Art Directory, pp.* 14 *and* 38), *are also qualified to earn payments on the results of their instruction in subjects I., II., and III.* (see *list of Science subjects, p.* 19), *as tested by the May Science examinations, provided that such instruction has been given under the supervision of a Local Com-*

mittee constituted according to Rule IV. (see *p.* 11), *and approved by the Department before the* 31*st January previous to the examination.*

Students on whom payments are claimed under this regulation must be of the artisan or industrial classes (see *Rule XXV., p.* 19), *and must have received* 25 *lessons at least in each subject in the year, or since the last examination on their passing, at which payment was claimed on their account* (see *Rule XXIV., p.* 18). *The other regulations applying to Science Classes, such as the keeping of registers on approved forms* (*Rule XXXI., p.* 21), *&c., must also be observed.*

LXIII. In order to encourage the artistic ability which may be shown in drawings of buildings and machines executed by students in Science classes, as exercises in Subjects II. and III. (see *List of Science Subjects, p.* 10), *additional grants are made on the same scale as those for works executed in Art schools or classes.* *Extra grants in Subjects II. and III.*

a. The Local Committee or the Teacher of a Science school or class satisfying the conditions stated in the next rule is entitled to receive a payment not exceeding 15*s. for any one student, on account of every artisan student who shall submit satisfactory works executed in the school or class during the then current school year,*

(1.) *In Mechanical and Machine drawing; and,*

(2.) *In drawing details of Architecture from copies.*

(*Art Directory, p.* 24, § 3*b, and pp.* 33 *and* 36, *Stages* 1*b and* 23*a.*

b. The Local Committee or the Teacher of a Science school or class is entitled to receive a payment not exceeding 20*s. for any one student, on account of every artisan student who shall submit satisfactory works, executed in the school or class during the then current school year, in drawing or designing for Architecture.*

(See *Art Directory, p.* 24, § 3*c, and p.* 36, *Stage* 23*b.*)

c. Architectural Drawings of the class referred to in the preceding paragraph (§ *b*), *executed by students in Science schools or classes are admissible to the advantages of the National Art Competition.* (See *Art Directory*, *p.* 29, § 11.)

The works of students of classes in subjects II. and III. are not excluded from the advantages of this rule, even if such students should be teachers in other Science subjects.

Condition of obtaining extra grants.

LXIV. Local Committees, Teachers, and Students of Science schools may avail themselves of the aid offered under the provisions of the above rule on the following conditions, namely;—

a. That the School or Class be constituted in accordance with the regulations of the Science Directory (*Rules III. and IV.*, *p.* 11).

b. That the Teacher be duly qualified in accordance with Rule XXII. (see *p.* 17), *to earn payments on the results of examination in Subjects II. and III.*

c. That Teachers who have thus qualified themselves to earn payments in Subject II. or Subject III., subsequent to the year 1868, *must also have passed the second grade examination in Freehand Drawing* (see *Art Directory*, *p.* 14).

d. That a Teacher who has thus qualified himself before the year 1869, *must have passed not less than one hundred pupils in either subject, or fifty in both subjects.*

Full particulars of the aid given to Art schools and classes will be found in the Art Directory, which can be had on application to the Secretary Science and Art Department.

Free admissions to School of Mines and College of Science.

LXV. Free admissions to the lectures at the Royal School of Mines, Jermyn Street, or the Royal College of Science, Dublin, are granted to any person who takes a gold medal in the May examination.

Admission to Educational and Art Libraries.

LXVI. Candidates who have obtained a first or second class in the advanced stage may obtain tickets of admission to the Educational and Art Libraries at

the South Kensington Museum on application, by letter, addressed to the Secretary of the Science and Art Department.

LXVII. Science teachers who have taught two years consecutively and passed not less than 30 students each year, are allowed 2nd class railway fare and 3*l.* towards their expenses while living in London for the purpose of visiting the South Kensington Museum and other Metropolitan institutions, in order that they may acquire for the benefit of their students a knowledge of the latest progress in those educational subjects which affect the schools, on condition that they remain there five days at least. **Visits of teachers to London.**

Special arrangements with regard to these visits may be made from year to year.

Before he proposes to take advantage of the grant the teacher must make application to the Secretary, Science and Art Department: he must also keep a diary (*apply for* Science Form No. 302) during his stay in London, giving the names of the institutions he has visited, with brief observations on them.

Note.—All the forms alluded to in this Directory can be had on application to the Secretary, Science and Art Department, South Kensington, London, W.

Letters addressed thus need not be prepaid in the post.

APPENDIX A.

FORMS and INSTRUCTIONS for GUIDANCE in establishing and maintaining SCIENCE SCHOOLS and CLASSES.

SCIENCE FORM, No. 170.

MEMORANDA FOR THE USE OF SECRETARIES AND MEMBERS OF SCIENCE COMMITTEES.

Dates.	
Constantly - - -	To visit the School and see that the Registers are kept from day to day, and that the regulations of the Department are duly carried out.
When required -	To summon a meeting of the Committee on the occasion of the visit of the Inspector.
1*st November* -	The Report, Science Form No. 120, informing the Department of the existence of a school must be carefully filled in and sent immediately on its opening, or if it be an old school, on its re-assembling after the vacation. This must be ~~accompanied or closely fo~~llowed by Form No. 88, forming the Committee, or No. 168, continuing a Committee. *Note.—If the Committee of any School or Class has not been at least provisionally approved by the Department before the* 1*st of February in any year, no payments will be made on the results of the examination of that School or Class in the ensuing May.*
Before 28*th Feb.* -	To send Form No. 329, stating in what subjects examination will be required.
Before 31*st March*	To send Form No. 119, giving the precise number of candidates in each subject at the examination in May. *Note.—No examination will be held where these forms have not been sent in by the dates named.*
Before 24*th April* -	To see that Form No. 91 is hung up in the School-room.
On the 27*th April*	If a parcel containing (1) the papers for the candidates to work upon, (2) copies of Form No. 91, one for each day's examination, and (3) envelopes in which to return the worked papers, should not have been received, or if there should be any mistake in the numbers sent for each subject as applied for, or in the covering letter, to communicate *at once* to the Department.
During the May examinations.	The examination papers for each evening will leave London by the night mail two evenings before, *i.e.*, Thursday evening papers will leave on Tuesday evening, Friday's on Wednesday evening, etc. Should they not arrive accordingly, a telegram to be sent *at once* to the Department.

On the evening of examination. The candidates, being all seated at 6.50, to read out the rules on Form No. 91, then give out the papers to be worked on. Then at 6.55 to break the seal of the examination papers and distribute to the candidates. To adhere rigidly to the rules on Form No. 91. To sign Form No. 91. To seal up the papers in one of the envelopes provided and at once post them.

After the May examinations. On receiving lists of the results, to give one copy to each candidate whose name appears in it as being successful; to inform the others that they have failed.

To return, as soon as possible, Form No. 161, filled up in strict accordance with the rules on Form No. 110. (Prize List). To call a meeting of the Committee to examine and certify the Teacher's claims for payment, Form No. 51, and the School and Class Registers, which must be sent up at the same time. To return Form No. 108.

To keep a record, and inform the Department, of the number of individuals examined.

SCIENCE AND ART FORM, No. 88.

LOCAL COMMITTEES FOR SCHOOLS AND CLASSES RECEIVING AID THROUGH THE SCIENCE AND ART DEPARTMENT.

1. A Local Committee of not less than five well-known responsible persons must be formed in connexion with every school or class, in order to comply with the necessary requirements of the Science and Art Department, and to carry out various arrangements on its behalf necessary for testing the efficiency of the instruction, on the proof of which alone the aid of the Department will be given.

2. The gentlemen who intend to act on this Committee must sign the form on the next page, stating their willingness to carry out the necessary arrangements for examinations, and to observe all the regulations of the Department; each member after signing must also give his address and occupation. Care must be taken that the members who sign the form are properly acquainted with the duties they propose to discharge; a summary of these duties is given below (see § 5), and they are laid down at greater length in the Science and Art Directories, which can be obtained on application to the Secretary of the Department.

3. When a school or class is first formed, the form on the next page must be signed at a general meeting of the Committee. If the same Committee continue to act, it will only be necessary to fill up Form No. 168, which expresses the willingness of the members to undertake their duties for another year: but no one can be a member of a Committee, nor assist in the conduct of an examination, who has not signed the form on the next page.

4. The relation of the teacher to the Committee of a school or class will vary much, according to the varying circumstances of different

localities. With this and other local arrangements the Science and Art Department does not interfere, but leaves them to the locality to settle.

5. The Science and Art Department requires that the Local Committee shall—

a. Be responsible for the safe custody of all apparatus towards the purchase of which the Department has granted aid.

b. Provide a room or rooms of sufficient size to carry out the annual examination according to the detailed regulations under that head. This examination is of *all* persons who wish to present themselves, and not only of those attending the school or class; but those persons who do not belong to the school or class must send in their names at the appointed time, and may be required to pay a registration fee of 2*s.* 6*d.* for the whole examination.

c. See that school registers, showing the occupations of the various students, their attendance, number of lessons, payments of fees, &c., on approved forms, be kept properly filled up, and sent to the Science and Art Department when required.

d. Send, when required, to the Secretary of the Science and Art Department the list of students to be examined, specifying the subjects in which they are to be examined. Be responsible for conducting and superintending the examinations in accordance with the rules of the Department; giving out the examination papers which will be sent for that purpose: seeing them fairly worked and certifying to the same, not less than three of the Committee being always present: and sending the worked papers, under seal, by the day's post to the Secretary of the Science and Art Department.

e. When required, transmit to South Kensington works for examination executed in the school during the previous year, and make an annual report of the proceedings of the school or class.

f. Certify that those students on whose examination claims to payments on results are based, are artisans or operatives, or can claim as such; and that the payments claimed are due according to the regulations.

g. Certify that those students, on account of whose instruction in Science payments are claimed, have received 25 lessons at least from the teacher in the year, or since the last examination, on their passing at which payment was claimed on their account.

6. The school or class must be at all times open to the visit and inspection of the officers of the Science and Art Department as a condition for the grant of aid from it; if at any time it is found that the apparatus, examples, &c., towards the purchase of which a grant has been made are not properly taken care of, or that a proper room with firing, lighting, &c., is not provided for the class, the aid of the Department will be withdrawn.

7. The school or class will be inspected periodically by an officer of the Science and Art Department, who will report whether the regulations be strictly carried out. At his visits, of which due notice will be given, a meeting of the Committee must be held to receive him, at which as many of the members as possible are expected to attend.

Form of Application to act as a Committee for a School or Class receiving Aid through the Science and Art Department.

This Form is to be filled in, signed at a general meeting of the Committee, and returned to the Department immediately on the formation of a school or class.

If the Committee of any school or class has not been at least provisionally approved by the Department before the 1st *February in any year, no payments will be made on the results of the examination in the ensuing May of that school or class.*

When a Committee continues to act for another year for a school or class, Form No. 168 *should be transmitted instead of this form.*

We, the undersigned,

[*h.* The Committee must consist of a Chairman, Secretary, and at least three other Members, and must be composed entirely of well-known responsible persons of independent position, who have no such personal interest in the school or class as can lay them open to the slightest suspicion of partiality. Relations and pupils of the teacher, persons under instruction in any school or class receiving aid from the Science and Art Department, and teachers of any description having pupils who are candidates for the examinations of the Department, are not eligible as members of the Committee.

Note.—A gentleman whose son attends any examination of the Science and Art Department is thereby disqualified from superintending any of the examinations that year, though he may act on the Committee in other respects.

i. It is very desirable that as many persons as possible in recognised positions of public responsibility in the district, such as Magistrates, Municipal Authorities (Mayor, Aldermen, or Town Councillors), Heads of Educational Establishments (Trustees of Grammar Schools, Managers of National Schools), Clergymen, &c., should be on the Committee. It is absolutely necessary that at least two such responsible persons should agree to act.

k. The Chairman must be a Magistrate, Mayor, Boroughreeve, Provost, or Alderman, or other public officer of recognised position, Trustee of Grammar School, or Clergyman of the Established Church in parochial employment. He will have to certify that the constitution of the Committee is in accordance with the above requirements.

l. The Secretary of the Committee of the School or Class, as being the medium of communication, will carry on all correspondence with the Science and Art Department, and is held responsible for making out and sending all returns required, for the receipt and distribution of the examination papers, the transmission of the worked papers, &c., at the proper times according to the regulations.]

propose to act as the Local Committee for the

________________________________ [Science School, Science Class, School of Art, or Art Night Class.]

held at the ________________________________ [Name of Institution or Building.]

________________________________ [Name of Street or Place.]

________________________________ [Name of City, Town, or Village.]

and taught by ________________________________

____

________________________________ [Give the names of all the teachers.]

We undertake for the year ending 31st August 18   at least, and further till another Committee satisfactory to the Science and Art Department has been appointed,

1. To be responsible for the safe custody of all the Apparatus, Diagrams, Examples, Casts, &c., towards the purchase of which the Department has in any way contributed.
2. That three or more of our number will be ready at the appointed time to be present at, and superintend, the examinations of the School or Class according to the instructions of the Science and Art Department, and give the teachers the necessary vouchers.
3. That a room or rooms shall be provided for the due carrying out of such examination, according to the rules of the Department, providing sufficient space for the examination, not only of all persons taught in the School or Class, but of all others who may wish to attend the examination.
4. When required to transmit to South Kensington works for examination, and to make an annual report of the School or Class; and to comply with the regulations of the Science and Art Department.

   (A fee of not more than 2s. 6d. may be charged on each applicant for examination who is not a student in the class, to reimburse the Committee for any extra expenses they may be put to in providing a room.)
5. That the School or Class shall be open at any time to the visit and inspection of the Officers of the Science and Art Department.

SIGNATURE.	ADDRESS.	Occupation, specially stating how fulfilling the conditions of rules "*h*" and "*i*" above.
NOTE.—*On the formation of a Committee this form should be signed at a general meeting.*		
____________ *Chairman.*		
____________ *Secretary.*		

I certify that this Committee complies with the requirements of the rules *h*, *i*, and *k*.

____

Chairman.

The Secretary,
Science and Art Department,
South Kensington, London, W.

SCIENCE AND ART FORM, No. 168.

FORM OF APPLICATION TO RENEW A COMMITTEE.

To be sent in before the 30th November.

SIR,

WE have the honour to inform you that a meeting of the Committee of

the ______________________________ [Science School, Science Class, School of Art, or Art Night Class.]

established at the ______________________________ [Name of Institution or Building.]

at ______________________________ [Name of Town or Village.]

was held at the ______________________________ [Place of Meeting.]

on the ____________________, at which the following members were present:—

and we were authorised by them and the following members,

who could not attend, to inform you that they are prepared to continue to act

as the Committee of the ______________________________ [School or Class.]

for the year ending 31st August 18 .

We have also to inform you that additional members who have joined the Committee have signed the enclosed Form No. 88. [This paragraph to be erased if it does not apply.]

The School will be taught by the following teachers during the session:—

____

____

____

We have the honour to be, SIR,
Your obedient Servants,

______________________________ *Chairman.*

______________________________ *Secretary.*

To the Secretary,
Science and Art Department,
South Kensington, London, W.

SCIENCE FORM, No. 120.

SCIENCE CLASSES UNDER TEACHERS QUALIFIED TO EARN PAYMENTS.

ANNUAL REPORT OF SCIENCE SCHOOL OR CLASS,

To be made on its establishment, and annually immediately on recommencing after the summer vacation.

In all cases this form must be sent in before the 1st November.

Name of Town ____________________

Place, as Mechanics' Institution, &c., in which the Classes are held ____________________

Name of Street, No., &c. ____________________

Teachers' names.	Their private addresses.

Total No. of individual Students ____________

(If a student attends two or more classes he must only be counted as one student.)

CLASSES IN (state subject).	Fees.	No. of Students.	Days on which they meet.	Hours of Meeting.	Period of the Year during which the Classes continue.

____________________ *Secretary.*

____________________ *Address of Secretary.*

SCIENCE FORM, No. 51.

Application for Payment from ______________________ [Name of teacher.]

Science Teacher in ______________________ [Name of school or institution.]

at ______________________ [Name of town or village.]

On behalf of the Committee of Management of this School, We do hereby certify that:—

(1.) Mr. ______________________ has duly performed the various duties devolving upon him as a Science Teacher in the School, during the ________ ending ______ day of ______________ 18 .

(2.) He has given the following students at least 25 lessons during the year, or since the last examination at which payment was claimed on their account, in each subject for which payment is claimed.

(3.) The under-mentioned students belong to the industrial classes, as coming within one of the following categories, or are the children (not earning their own livelihood) of such:—

a. Artisans or operatives in the receipt of weekly wages.
b. Coastguards, policemen, and others who, though in the receipt of weekly wages, do not support themselves by manual labour.
c. Persons in the receipt of salaries not large enough to render them liable to the income tax, as some descriptions of clerks, shopmen, &c.
d. Small shopkeepers employing no one but members of their own family, and not assessed to the income tax.
e. Tradesmen and manufacturers on their own account, supporting themselves by their own manual labour, not employing apprentices, journeymen, &c., and not assessed to the income tax.

Examined and certified at a meeting of the Committee held for that purpose at ____________ [Place of meeting.] on the ______ day of ______ 18 .

______________________ *Chairman* or *Secretary.*

____
______________________ } *Two members of Committee.*

I hereby certify that the following particulars are correct.

______________________ *Teacher.*

______________________ [State how qualified to earn payment.]

Names of Passed Students.

N.B.—The names of the students must be arranged alphabetically. After each student's name must be placed, each in a separate line, his several successes (if he has more than one); and in the last column the amount claimed on each success, after making the proper deductions.

Surname.	Christian Name in full.	Age last Birthday.	Trade, or Father's Trade. When father's trade is given put (*f.*) after it.	State under which of the Categories, *a*, *b*, *c*, *d*, *e*, Claim is made.	Position at the late Examination. Subject. *In Roman Numerals.*	Stage. *A. or E.*	Class. *In Arabic Numerals.*	Highest Position in same Subject in any previous Examination.	Payment claimed.

Names of Passed Students.

N.B.—The names of the students must be arranged alphabetically. After each student's name must be placed, each in a separate line, his several successes (if he has more than one); and in the last column the amount claimed on each success, after making the proper deductions.

Surname.	Christian Name in full.	Age last Birthday.	Trade, or Father's Trade. When father's trade is given put (f.) after it.	State under which of the Categories, a, b, c, d, e, Claim is made.	Position at the late Examination. Subject. In Roman Numerals.	Stage. A. or E.	Class. In Arabic Numerals.	Highest Position in same Subject in any previous Examination.	Payment claimed.

Application for Travelling Allowance.

In the performance of my duties as teacher of the Science School at ________________________,
I have incurred the travelling expenses stated below, and claim payment for them in accordance with the terms of the Rule XXVIII. of the Science Directory.

____________________ *Teacher.*

Particulars of Expenses incurred.	Amount claimed.

We certify that the above particulars are correct, and that the journeys as stated have been duly made by the teacher.

____________________ *Chairman* or *Secretary.*

____________________ } *Two members of Committee.*
____________________ }

The Secretary,
Science and Art Department.

[SPECIMEN.]

SCIENCE FORM, No. 51.

Application for Payment from *William Brown,* [Name of teacher.]
Science Teacher in *the Mechanics' Institute,* [Name of school or institution.]
at *Worksop* [Name of town or village.]

On behalf of the Committee of Management of this School, We do hereby certify that:—

(1.) Mr. *William Brown* has duly performed the various duties devolving upon him as a Science Teacher in the School, during the *year* ending *30th* day of *June* 1870;

(2.) he has given the following students at least 25 lessons during the year, or since the last examination at which payment was claimed on their account, in each subject for which payment is claimed;

(3.) the under-mentioned students belong to the industrial classes, as coming within one of the following categories, or are the children (not earning their own livelihood) of such:

a. Artisans or operatives in the receipt of weekly wages.
b. Coastguards, policemen, and others, who though in the receipt of weekly wages, do not support themselves by manual labour.
c. Persons in the receipt of salaries not large enough to render them liable to the income tax, as some descriptions of clerks, shopmen, &c.
d. Small shopkeepers employing no one but members of their own family, and not assessed to the income tax.
e. Tradesmen and manufacturers on their own account, supporting themselves by their own manual labour, not employing apprentices, journeymen, &c., and not assessed to the income tax.

Examined and certified at a meeting of the Committee held for that purpose at *the Mechanics Institute, Worksop* [Place of meeting.] on the *25th* day of *July* 187*0*.

John Richards, Chairman ~~or Secretary~~.

Alfred H. Dickson
Walter Harrison } Two members of Committee.

I hereby certify that the following particulars are correct.

William Brown, Teacher.

2nd Class Certificate in I., II., III.; 1st Class in X. and XI., 1867; 2nd Class in VIII. and IX., 1868; 2nd Class Honours in IV., 1869. [State how qualified to earn payment.]

Names of Passed Students.

N.B.—The names of the students must be arranged alphabetically. After each student's name must be placed, each in a separate line, his several successes (if he has more than one); and in the last column the amount claimed on each success, after making the proper deductions.

Surname.	Christian Name in full.	Age last Birthday.	Trade or Father's Trade. When father's trade is given put (*f.*) after it.	State under which of the Categories, *a, b, c, d, e,* Claim is made.	Position at the late Examination.			Highest Position in same Subject in any previous Examination.	Payment claimed.
					Subject. *In Roman Numerals.*	Stage. *A. or E.*	Class. *In Arabic Numerals.*		
Adams	*John James.*	*14*	*Tailor (f.)*	*a.*	*X.*	*E.*	*1*	*E. 3*	*£2*
"	"	"	"	"	*XI.*	*E.*	*3*	—	*1*
			Carried over						*£3*

Names of Passed Students.

N.B.—The names of the students must be arranged alphabetically. After each student's name must be placed, each in a separate line, his several successes (if he has more than one); and in the last column the amount claimed on each success, after making the proper deductions.

Surname.	Christian Name in full.	Age last Birthday.	Trade, or Father's Trade. When father's trade is given put (*f.*) after it.	State under which of the Categories *a*, *b*, *c*, *d*, *e*, Claim is made.	Position at the late Examination. Subject. *In Roman Numerals.*	Stage. *A. or E.*	Class. *In Arabic Numerals.*	Highest Position in same Subject in any previous Examination.	Payment claimed.
			Brought forward	- -	- -	- -	- -	- -	*£3*
Carter -	*William Henry.*	*22*	*Clerk in Gas Works.*	*c.*	*X.*	*E.*	*1*	—	*3*
Jones -	*Richard*	*23*	*Bricklayer*	*a.*	*I.*	*A.*	*1*	*E. 2*	*3*
" -	"	"	"	"	*III.*	*A.*	*2*	*E. 2*	*2*
Robinson	*Peter Charles.*	*20*	*Fitter* -	*a.*	*I.*	*A.*	*1*	*E. 1*	*2*
"	"	"	" -	"	*II.*	*A.*	*2*	*E. 3*	*3*
"	"	"	" -	"	*IV.*	*E.*	*2*	—	*2*
Smith -	*Robert*	*13*	*Postman (f).*	*b.*	*VIII.*	*A.*	*1*	*E. 3*	*4*
" -	"	"	"	"	*IX.*	*E.*	*2*	*E. 3*	*1*
Watson	*Arthur H.*	*15*	*Publican (f).*	*d.*	*IV.*	*A.*	*1*	*A. 2*	*1*
									£24

Application for Travelling Allowance.

In the performance of my duties as teacher of the Science School at *Worksop*, I have incurred the travelling expenses stated below, and claim payment for them in accordance with the terms of the Rule XXVIII. of the Science Directory.

William Brown, Teacher.

Particulars of Expenses incurred.	Amount claimed.
	£ s. d.
Return fare, Sheffield to Worksop, 2nd class, 31 journeys at 4s. 3d. - - - - - -	*6 11 9*

We certify that the above particulars are correct, and that the journeys as stated have been duly made by the teacher.

John Richards, Chairman ~~or Secretary~~.

Alfred H. Dickson, } Two members of
Walter Harrison, } Committee.

– *The Secretary,*
Science and Art Department.

SCIENCE FORM, No. 91.

RULES FOR THE CONDUCT OF SCIENCE EXAMINATIONS.

The following rules must be hung up in the examination room for the information of the candidates one week before the examination. They should all be carefully read by the members of the Committee, and those applying to the candidates must be read aloud before the Committee and the candidates **on each night** *immediately before the examination begins.*

Directions to the Committee.

1. If one room is used, three of the Committee must be present during the whole of the examination, if more than one room then two of the Committee in each room, who must carefully watch the whole examination and see that candidates use no unfair means either by assisting one another or using books or notes. The members of the Committee can, if they wish it, relieve one another, as long as the correct number are always present. *No persons except those under examination, members of the Committee, and officers of the Science and Art Department are permitted to be present in the room during the examination.*

Note.—When there are not more than three candidates it will not be necessary for more than two members of the Committee to be present at the examination.

2. Places must be allotted to the candidates so that they may be seated at least five feet apart, from centre to centre. Ink and pens must be provided. All diagrams, &c., having reference to the subjects of the examination, must be removed from the walls of the examination room. All these arrangements for the accommodation of candidates should be completed by 6.30 p.m.

3. It may be of service to the Committee that the teacher of the class should attend before the examination begins to assist in getting the candidates into their places; his doing so, however, is at the discretion of the Committee. He may see the candidates fill up the forms on the outside of their papers and arrange them in classes for the elementary and the advanced papers, and for honours, which he will explain to the Committee so that there may be no confusion. But *he must leave the room before the examination papers are opened:* information of his having remained in, or returned to the room after this will lead to the examination being cancelled.

Note.—Should the teacher of the class wish to sit at the examination, he must apply specially to the Committee, so that they may arrange to have a table for him close to their own seats, and not with the other candidates.

4. The blank papers supplied by the Department for the candidates to write their answers on should be first distributed, and the Committee should see that the candidates commence by filling in their names, &c., where directed. The arrangement of the candidates and distribution of the papers should be completed before 6.50 p.m.

Note.—Should no candidate present himself for examination, the packet of examination papers must be returned to the Department by the next post *unopened.*

5. At 10 p.m. (on the nights of the examination in subjects I., II., and III., at 11 p.m.), or, as much sooner as all the candidates have completed their papers, the worked papers must be sealed up in the envelope supplied by the Department for that purpose. Before they are thus sealed up neither the teacher nor any other person, not being a member of the Committee, must be allowed to enter the room.

6. On these examinations depend large grants of public money. On their being fairly, honestly, and impartially carried out depends the continuance of the system. The Committees are intrusted with this duty. They will see, then, how necessary it is to be extremely careful in conducting the examinations, and to insist on the rules being complied with *to the letter*. They are therefore required to fill in and sign the certificate on the third page of this form, and to forward the same with each set of worked papers.

The worked papers of the candidates are, as will be seen from Rule 12, below, to be initialed by members of the Committee. This is to prevent personation. And the Committee will see how essential it is that this duty be not treated as a mere matter of form.

Regulations applying to the Candidates.

To be read to the Candidates on each evening before the Examination Questions are opened.

7. The candidates must be in their places at 6.50 p.m. After this time no candidate must be admitted except under very exceptional circumstances, and by express permission of the Committee, and then *only* if no person has left the room who has seen the examination paper. No candidate must on any account be admitted after 7.30 p.m.

8. The examination papers must be opened in the examination room in the presence of the Committee, at 6.55 p.m. No examination paper may on any pretence be taken from the room before 8 p.m.; nor after that hour until every candidate has completed and given up his worked paper.

9. Candidates should not bring anything with them into the examination room,* except pens and pencils. No *blotting paper*, scribbling paper, slates, or anything of the sort that might be passed from one candidate to another, is on any account to be allowed. Rough work and calculations must be done on the supplied form. The back of each leaf of the form, *i.e.*, pages 2, 4, 6, and 8, may be reserved for this purpose, the pen being drawn through to show that they are not for the examiner. *But nothing must be torn off the form.* All books, note-books, &c. must be collected by the Committee.

10. Candidates must not on any pretence whatever speak to one another after the papers have been given out. If a candidate should require to ask a question, he will hold up his hand, when a member of the Committee will attend to him, but no question on the meaning of any portion of the examination paper must be asked or answered.

11. When the examination papers have been given out no candidate must be allowed to return after having once left the room.† On a candidate leaving the room before the examination is over his worked paper and examination questions must be taken up, and he must deliver his paper of questions to the Committee. At 10 p.m., precisely,‡ all the candidates' papers must be collected. It will therefore be advisable to warn them ten minutes before the time. When a candidate has completed his work before 10 p.m. he should, with the permission of the Committee, go away, though not before 8 o'clock, after his worked paper has been taken by a member of the Committee.

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* Except such as by the Time Table (Science Form, No. 90) are required.

† It will, therefore, be desirable to make some arrangements for the candidates to retire within the room.

‡ Except in the Drawing Examinations, subjects 1, 2, and 3, then the hour is 11 p.m.

12. The papers must be initialed, by the Committee as directed, as they are received from each candidate, as a guarantee that each has been worked by him whose name, &c. it bears.

13. *Should a candidate break any of the foregoing rules, or use unfair means of any description, he must be at once expelled the examination room, and his paper cancelled, the Committee stating on it the cause of his expulsion.*

CERTIFICATE BY THE COMMITTEE.

To be filled in and signed by the Committee and forwarded with each set of worked papers.

We, the undersigned members of the Committee of the Science School or Class held at ______________________________

______________________________ [name of institution and town.] in ______ [state number of] rooms hereby certify that we were present during the examination in ______________________________ [state Subject.] held in the ______________________________ [name of building.] on the evening of the ______________ where the accompanying papers were worked in our presence, and that the foregoing rules have been strictly complied with.

Dated this __________ day of ______________ 18 .

Signatures.	Time Present.	
	Hour of Arrival.	Hour of Departure.

FORM No. 694.

SUMMARY of the LAW relating (I.) to the ESTABLISHMENT and MAINTENANCE of PUBLIC LIBRARIES, MUSEUMS, and SCHOOLS of SCIENCE and ART, and (II.) to the ACQUISITION of SITES for such INSTITUTIONS.

N.B.—This summary has been prepared for the **general information only** *of persons desiring to establish Museums and Science and Art Schools, but it must be clearly understood that the Department does not hold itself responsible for its legal accuracy, and the promoters of such institutions are recommended not to take any definite proceedings under the Acts without availing themselves of professional advice.*

I.

1. Any town, parish, district, or union of parishes, is empowered by Act of Parliament (the Act for England is the 18 and 19 Vict. c. 70, Public Libraries Act, 1855; amended by the 29 and 30 Vict. c. 114. *As regards Scotland and Ireland, see* §§ 10 and 11 *below*), to levy a rate not exceeding one penny in the pound for the establishment and maintenance of buildings, with the requisite appliances, suitable for Public Libraries and Museums, or for Schools of Science or Art, or for any or all of these purposes, provided that a majority of more than one-half of the ratepayers present at a public meeting, duly convened, vote in favour of adopting the provisions of the Act.

2. The preliminary steps to be taken with a view to the adoption of the Act are these :—

(*a.*) In *Municipal Boroughs* the Act requires that the mayor shall convene a public meeting on the request of the town council, or on the request in writing of any ten resident ratepayers;

(*b.*) In *Districts* within the limits of any Improvement Act, the district board is to convene a meeting upon the requisition in writing of at least ten resident ratepayers; and

(*c.*) In *Parishes*, the overseers of the poor, on the written requisition of ten resident ratepayers, are to convene a meeting to determine whether the Act shall be adopted.

3. In each case it is necessary that ten clear days' notice of the time, place, and object of the meeting be given by affixing the same on or near the door of every church and chapel, and at least seven days' notice by advertisement in a newspaper published or circulating in the borough, district, or parish, as the case may be.

4. Any expenses incurred in connexion with the meeting, whether the Act be adopted or not, are chargeable upon the borough fund or rates, and may be defrayed, if necessary, by a separate rate specially levied for the purpose, such rate not to exceed one penny in the pound.

5. If any meeting duly convened to determine as to the adoption of the Act decides against it, no meeting for a similar purpose can be held until the expiration of at least a year from the time of holding the previous meeting.

6. If the Act be adopted the organisation for carrying its provisions into operation is as follows :—

(*a.*) In *Boroughs.* "The management, regulation, and control of " libraries and museums, schools for Science and Art, shall be " vested in and exercised by the council," or by such committee

as the council may appoint, and the members of the committee are not required to be members of the council.

(*b.*) In *Districts.* The board or trustees acting in the execution of the Improvement Act, or a committee appointed by them.

(*c.*) In *Parishes.* Not less than three nor more than nine commissioners to be appointed by the vestry, are constituted a body corporate for the purposes of the Act, under the name of "The "Commissioners for Public Libraries and Museums for the Parish "of ——— in the County of ———."

7. The council, board, or commissioners are empowered to borrow money at interest, on the security of a mortgage or bond of the borough funds, or of the rate levied under the Act; and the provisions of the Companies Clauses, and Lands Clauses Consolidation Acts, 1845, are incorporated with the Public Libraries Act.

8. Where two or more neighbouring parishes combine for the purposes of the Act, each parish is to appoint not more than three commissioners, and the commissioners for the several parishes are to form one body corporate, and to act together in the execution of the Act. The expenses of carrying the Act into operation are to be borne by the parishes in such proportions as they may mutually approve.

9. It is important to observe that where a public museum or library has been already established under any Act relating to public libraries or museums, a similar institution, such as a School of Science or Art, may be established in connexion therewith without any further proceedings being taken under the Act.

10. The following are the general Acts of Parliament relating to the establishment and maintenance of public libraries, museums and Schools of Science or Art. Those printed in italics have been superseded by the others:—

Stats. 8 *and* 9 *Vict. c.* 43; 13 *and* 14 *Vict. c.* 65; 16 *and* 17 *Vict. c.* 101; 17 *and* 18 *Vict. c.* 64; 17 *and* 18 *Vict. c.* 103; 18 and 19 Vict. c. 40 (Public Libraries Act, Ireland, 1855); 18 and 19 Vict. c. 70 (Public Libraries Act, 1855); 29 and 30 Vict. c. 114 (Public Libraries Amendment Act, England and Scotland, 1865), repealed so far as it relates to Scotland by the 30 and 31 Vict. c. 37 (Public Libraries Act, Scotland, 1867).

11. The provisions relating to the establishment and maintenance of libraries and museums, &c. in Scotland and Ireland are substantially the same as the provisions of the Act for England, but there are some differences in matters of detail, for which it will be advisable to refer to the Acts themselves, namely, for Scotland, Stat. 30 and 31 Vict. c. 37, and for Ireland, Stat. 18 and 19 Vict. c. 40.

II.

12. By 17 and 18 Vict. c. 112 (intituled "The Literary and Scientific "Institutions Act")—after reciting the expediency of affording greater facilities for obtaining and settling sites and buildings in trust for institutions established for the promotion of literature, science or art, or for the diffusion of useful knowledge; it is provided that such persons and corporations, as are described in the 4 and 5 Vict. c. 38,* may

* These are, (1) any person being seised legally or equitably in fee simple, fee tail, or for life, in any manors or lands of freehold, copyhold, or customary tenure, and having the beneficial interest therein, in possession for the time being; and (2) any corporation, ecclesiastical or lay, sole or aggregate, in whom land may be, in any manner, vested,—subject to the proviso that no ecclesiastical corporation sole below the dignity of a bishop may make such grant without the consent in writing of the bishop of the diocese.

grant, convey, or enfranchise, either by gift, sale, or exchange, in fee simple, or for a term of years, any quantity, not exceeding one acre of their land, for each separate institution, as a site for such institution.

13. These powers are subject to provisos that they shall not be exercised by tenants for life unless the person or persons next in remainder join in the grant; that in case of gratuitous conveyance of waste or commonable land by any lord of a manor, the rights of all commoners and others having interest shall be barred; and that upon any land so granted by way of gift ceasing to be used for the purposes of the institution, it shall revert to the estate out of which it was granted, except only that when the institution is removed to another site, the land may be exchanged or sold for the benefit of the institution. The same Act, of 17 and 18 Vict. c. 112, contains numerous provisions relating to the persons by and to whom, and the manner in which, conveyances may be made; the form of such conveyances; the subsequent sale or exchange of the land; the liability of trustees to whom land is conveyed in trust; the ownership of any personal property belonging to the institution; the power to make byelaws; and the manner in which the institution may afterwards extend or abridge the purposes for which it was established, or may effect its own dissolution or the adjustment of its affairs.

14. The Act applies to every institution, for the time being, established for the promotion of science, literature, the fine arts, for adult instruction, and for the diffusion of useful knowledge. It also applies to the foundation and maintenance of libraries or reading rooms for general use among the members or open to the public, of public museums and galleries of paintings and other works of art, collections of natural history, mechanical and philosophical inventions, instruments, or designs.

15. The conveyance of sites to trustees, or others associated together for educational purposes, has been still further facilitated by recent legislation. It is no longer necessary to acknowledge any deed in order that it may be enrolled in the Court of Chancery (Act 31 and 32 Vict. c. 44. s. 3). If the grantor be a corporation, or if the conveyance be really and bonâ fide made for a full and valuable consideration, enrolment is no longer *compulsory*, although it is still permitted; but in all cases of voluntary grants by individuals, the deed must still, in conformity with the Mortmain Acts (9 George II. c. 36, 9 George IV. c. 85), be enrolled within six calendar months from the date of its execution (31 and 32 Vict. c. 44. s. 2).

SCIENCE FORM, No. 349.

REGULATIONS UNDER WHICH BUILDING GRANTS TO SCHOOLS OF SCIENCE ARE MADE.

1. A grant in aid of a new building suitable for a School of Science, or for the adaptation of an existing building, will be made provided that the school be built—

   a. Under the Public Libraries Act (13 & 14 Vict. c. 65., 18 & 19 Vict. c. 70., 29 & 30 Vict. c. 114.), or,

   b. In connexion with a School of Art aided by a Department building grant; and subject to the conditions herein-after set forth.

2. All applications for grants out of the parliamentary vote for any year must be sent in on or before the 15th day of November in the year preceding.

3. No grant will be made unless their Lordships are satisfied that,—

a. There is a population in the neighbourhood which requires a School of Science.

b. The school is likely to be maintained in efficiency.

4. No grant will exceed 2*s*. 6*d*. per square foot of internal area, and no grant will exceed 500*l*.

5. The site, plans, estimates, specifications, title and trust deed, must be satisfactory to the Lords of the Committee of Council on Education.

6. A plan of the site must be forwarded drawn to a scale of one-eighth of an inch to a foot, and showing the boundaries, approaches, and abuttals.

7. The site must be—

a. In a situation not unhealthy or noisy.

b. Within convenient distance of the homes of the students.

c. If possible freehold in tenure, without incumbrance of rights reserved over the surface, or reservation of minerals.*

8. The size and number of rooms will depend on local circumstances and the different sciences to be taught in the school. The plans and sections must be submitted with the application for the grant, and the proposed buildings must be in accordance with the regulations then in force as to size and distribution of rooms, ventilation, and substantial construction.

9. In cases where they may think it necessary, their Lordships will send an officer of the Department to inspect and report on the suitability of the building and site for the purposes of a School of Science.

10. The plans, specifications, and estimates when approved and sealed may be returned to the promoters for use, but must be lodged in the Science and Art Department.

11. A trust deed must be prepared providing—

a. That the building be used † as "a school for the instruction of "children and adults in the pure and natural sciences appli- "cable to industry and manufactures."

b. That it shall be open at all times to the inspection of the officers of the Science and Art Department.

c. That the students shall be instructed by teachers qualified to earn payments on the result of their teaching.

d. For the constitution of a body of responsible trustees and a committee of management.

12. This trust deed must not be executed until it has been approved in draft by the Lords of the Committee of Council on Education.

13. When the trust deed has been executed, and if necessary enrolled, a copy of it, including all signatures, attestations, and endorsements, must be made on plain unstamped paper, and lodged in the Science and Art Department.

14. The grant is made on presentation of a certificate (with balance sheet annexed) by the building committee of the school, setting forth that the building and conveyance are duly completed, and that the money in hand will, when added to the grant, meet all claims and finally close the account.

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* A leasehold site is not accepted by their Lordships when a freehold site can be obtained.

† If any power of sale, or of appropriating the premises to other uses than those of a School of Science be reserved, the deed must contain a condition securing the repayment of the grant to the Lords of Her Majesty's Treasury.

APPENDIX B.

SYLLABUS of the SUBJECTS in which EXAMINATIONS in SCIENCE are held by the DEPARTMENT OF SCIENCE AND ART.

SYLLABUS OF THE SCIENCE SUBJECTS.

THE following Syllabus has been prepared in order to afford candidates some guide to their reading; but it must be understood that the questions in the examination need not necessarily be on the specific points enumerated.

The examination is by paper, but oral examination may be resorted to. The examination in each subject is distinct. Mention is made of text-books solely to afford a candidate some assistance in selection, and a general idea of the scope of the examination, *and not at all to confine his reading to those works, or to assert that they are the best on the subjects they treat of.*

SUBJECT I.—PRACTICAL GEOMETRY.

Every one employed in any constructive art must acquire the power of representing on paper the forms and proportions of the work to be executed, whether it be of machinery, or of civil or naval architecture; and others, not immediately interested in construction require, in surveying, navigation, &c. a knowledge of practical as well as theoretical geometry of a more than elementary order.

Since it is essential to their utility that geometrical drawing should be accurate, the draughtsman must by practice and instruction be sufficiently acquainted with geometry to be able to apply its theorems with readiness and precision, and be sufficiently skilful in the use of his instruments and materials to ensure neatness as well as accuracy in execution: without these qualifications it is assumed that no one will present himself for examination in this subject.

But although prepared to this extent, the subject may be new to many, especially to those not acquainted with the application of arithmetic and algebra to geometry; it may therefore be necessary to apprise candidates, not only of what kind of knowledge will be expected, but of the form in which the examination papers will be drawn up.

Each section will be divided into three questions, of which the candidate may select which he pleases, but as he will in no case be allowed the numerical credit attached to each for more than one question from each section, he is advised to consider which he is most certain of, and not to

attempt more questions altogether than he is confident of completing in the time allowed for the examination.

The candidate must also understand that he must strictly comply with the conditions of each question, and not imagine that by substituting others, provided they are analogous, he may obtain credit for his answer; strict impartiality would be violated by any such latitude.

Each paper will contain questions in both plane and solid geometry, and to obtain a class in either the elementary, the advanced, or the honours course, half the questions at least answered by the candidate must be from the latter subject.

First Stage or Elementary Course.

Plane Geometry.

1. To divide finite lines in any ratio expressed either—
   a. By *numbers*, integral or fractional, as *m*, *n*, *p*:
   b. Or by given lines, as AB, PQ, &c.
2. To find a mean proportional, a third or fourth proportional to two or three given lines.
3. To divide finite lines so that the *area* of the rectangle contained by the segments may be of a proposed magnitude, given either—
   a. By numbers as above; or
   b. By a given polygon.
4. To construct a rectangle equal in area to that of a given polygon.
5. To construct a polygon from any sufficient data, as—
   a. Its species and *perimeter*.
   b. Its species and *area*.
   c. Similar to a given one, but on a given line, as a base or side, or of a given area.
6. To reduce a polygon of four or more sides to an equivalent triangle.
7. To draw circles to touch given lines or circles, either—
   a. Of a proposed radius; or
   b. To pass through one or two given points.

Solid Geometry.

A general knowledge of the principles of *Projection* on two or three planes supposed to be at right angles to each other is necessary before attempting any of the following constructions, these projections are called *Plans, Elevations, Profiles,* or *Sections.*

1. To represent by a *plan* and *elevation* any simple solid, when its form and its position with respect to the horizontal and vertical planes of projection (as represented by the paper) is given by adequate conditions.
2. To deduce a second or third elevation or plan of such a solid from a plan and elevation previously determined.
3. To determine by its plan, elevation, or by its *traces*, an indefinite line or plane in any position with respect to the paper as representing the horizontal plane.

The *points* in which any line intersects the planes of projection are called the *traces* of that line; and the *lines* in which any *plane*, or other surface, intersects the same planes are termed the *traces* of that surface; these terms *traces* are never used in any other sense.

4. To determine lines passing through a given point parallel, perpendicular, or inclined at any angle to a given line, neither point nor line being in the paper.

5. To determine a plane to contain a given point (not in the paper), either parallel or perpendicular to a given plane.
6. To determine by its plan and elevation any plane figure when its position with respect to the planes of projection is given, either—
   - *a.* By the inclinations to the paper of its plane and of one side.
   - *b.* By the inclinations of two of its lines.
   - *c.* By any other adequate data.

The principle on which this construction is made is the basis of all practical solid geometry. It is that *any* two planes may be supposed to be brought to coincide by the revolving of either of them on their mutual intersection; the construction itself when made or implied has recently been termed *rebattment* (from the French). It is by this supposition that the paper represents both co-ordinate planes of projection.

Second Stage or Advanced Course.

Plane Geometry.

1. The division of finite lines, or those lines produced under any of the conditions stated in the previous course, or under those of a more comprehensive character, such as harmonically, &c.
2. To determine by construction *lines* which shall be equivalent to magnitudes given by algebraical expressions, such as—

   a. $\sqrt{m}$, $\sqrt{\frac{m}{n}}$, $\sqrt{\frac{1}{m}}$; (m and n being *numbers*.)

   b. $\overline{a^2 \pm b^2}$, $\sqrt{ab}$, $\frac{\sqrt{ab}}{c}$, $\frac{\sqrt{m \pm n}}{k}$, &c., &c.
3. The construction of polygons from adequate conditions of sides, angles, area, perimeter or trigonometrical functions, as sin A, cos B, tan C, &c.
4. The division of polygons into m areas by parallel lines, or by lines drawn through a given point.
5. To draw circles to touch given lines and circles and to pass through two given points.
6. The construction of those plane curves which are required in practical arts (ellipse, parabola, cycloid, spirals, &c., &c.)
7. The construction of "scales" to drawings, to different units of measure, English and foreign.

Solid Geometry.

In addition to those elementary constructions mentioned in the preceding course, and under other and more advanced conditions, the candidate will be required to construct,—

1. The graphical representation of curved surfaces of revolution by their sections or otherwise.
2. The representation of such surfaces, either touching or intersecting each other, according to some given condition.
3. The determination of planes touching such surfaces, and containing given lines or points, or else cutting such surfaces under given conditions.
4. The *development* of conical and cylindrical surfaces, with that of lines on those surfaces.
5. The determination of the shadows of solid bodies bounded either by planes or curved surfaces by parallel or converging rays of light, the shadows being cast on planes.

N.B.—The questions for examination in this advanced course will thus comprise all the first course as regards both plane and solid geometry, only under more complex conditions. Thus, for example, the candidate will be required to determine the plan and elevation of solids of any kind from a plan and elevation of more easy delineation than that required; this construction may be termed by analogy the practical *transformation of co-ordinates.*

Examination for Honours.

Plane Geometry.

Candidates for honours will be required to make constructions relating to the contact of lines and circles with each other, and with other curves, requiring more knowledge of geometry and the power of making deductions, than is expected of other candidates; but the questions on these and other subjects will be of a practical utility in geometrical drawing. They must possess some knowledge of analytical geometry so as to be able to construct lines or circles given by algebraical expressions referring to co-ordinate geometry of two dimensions such as $\frac{x}{a}+\frac{y}{b}=1$; $x \sin A + y \cos A - p = 0$; $(x-a)^2+(y-b)^2=r^2$, &c., &c.

Solid Geometry.

The candidate will be expected to be conversant with the principles of co-ordinate geometry of three dimensions so far as to determine by their projections on three rectangular planes, points, and lines, and by their *traces* planes, the position of which is given by their equations such as—

$$(x=\pm a,\ y=\pm b);\ (y=mx+n,\ z=kx+l);\ \frac{x}{a}\pm\frac{y}{b}\pm\frac{z}{c}=1;$$
$$x\cos A \pm y \cos B \pm z \cos C \pm p = 0;$$
$$(x-a)^2 \pm (y-b)^2 \pm (z-c)^2 = r^2, \text{ \&c., \&c.}$$

He will be expected to demonstrate some theorems of this subject on which constructions are based relating to the parallelism or perpendicularity of lines and planes, and the relation of the projections of areas to the originals.

He will have to construct lines and planes inclined to given planes at oblique angles, and lines and planes touching surfaces of the second order, as the ellipsoid, paraboloid, &c., &c.

He must, by the projections of their generators, define surfaces, the *law* of their generation being given, and determine tangent and normal planes to such surfaces.

When surfaces of any order are represented by the projections of sections made by parallel equidistant horizontal planes, they are said to be *contoured.* This mode of graphically defining surfaces is by far the most useful; in surveying it is employed to represent the natural ground or the earth-works constructed in embanking, tunnelling, fortification, &c.; the lines of contours suggesting to the eye the nature of the surface as regards its inclination, slope, or its variations in horizontal direction.

The *contours* of geometrical surfaces are geometrical lines capable of accurate determination and construction, the candidate will be required occasionally to show surfaces plane or curved by their contours.

The mutual intersections of curved surfaces are *curves of double curvature,* which can only be represented by their projections; and normal and osculatory planes to such lines can only be drawn when the

surfaces on which these lines lie can be graphically represented. Easy cases of these constructions are required by the carpenter, by the mason, and shipwright, in the construction of vaults, cupolas, oblique bridges, vessels, and on other occasions.

Many problems are solved by the principle of development, such as the solution of the spherical triangle, the construction of maps.

The candidate must be acquainted with the principles of *perspective* or radial projection, so as to be able to represent any building on those principles, but he must also understand the determination of the radial projection of simple solids deduced from their orthographic projection, and the construction of planes and lines analogous to the elementary constructions of orthographic projection.

The candidate cannot be expected to make complicated constructions in the time allowed for this examination, but the questions will be so selected and diversified that he can prove his knowledge of all the subjects of this syllabus by the easy constructions those questions may require, and such demonstrations or definitions he may be called on to make may be quickly given in brief expressions, either in words or algebraically.

The following books are recommended for study in Subject I. :—

For Theoretical Geometry.

Euclid's Elements of Geometry (School Edition), by R. Potts, 12mo., 4*s*. 6*d*. (London, Longman, 1868.)

Plane Geometry according to Euclid (Chambers' Series), by A. Bell, 12mo., 1*s*. 6*d*. (London, Chambers.)

Elements of Euclid (Weale's Series), by H. Law, 12mo., 2*s*. (London, Virtue, 5th ed., 1868.)

Manual of Euclid, by J. A. Galbraith and S. Haughton, 12mo., two parts, 2*s*. 6*d*. each. (London, Cassell, 1868.)

Principles of Modern Geometry, by J. Mulcahy, 8vo., 9*s*. (London, Simpkin, 2nd ed., 1862.)

Éléments de Géométrie, par Legendre, *avec Notes* par Blanchet, 8vo., 4*s*. (Paris, Didot, 11th ed., 1867.)

For Analytical Geometry.

Treatise on Plane Co-ordinate Geometry as applied to the Straight Line and the Conic Sections, by I. Todhunter, 8vo., 7*s*. 6*d*. (London, Macmillan, 4th ed., 1867.)

A Treatise on Conic Sections, by G. Salmon, 8vo., 12*s*. (London, Longman, 4th ed., 1863.)

Analytical Geometry of Three Dimensions, by G. Salmon, 8vo., 12*s*. (Dublin, Hodges & Smith, 2nd ed., 1865.)

Treatise on the Analytical Geometry of Three Dimensions, by J. Hymers, 8vo., 10*s*. 6*d*. (Cambridge, Deighton, 3rd ed.).

Éléments de Géométrie, par S. F. Lacroix, 8vo., 4*s*. (Paris, 1863.)

Analyse appliquée à la Géométrie des trois Dimensions, par C. F. A. Leroy, 8vo., 6*s*. (Paris, 1854.)

For Practical Geometry.

Practical Geometry, by Thos. Tate (Gleig's series), 18mo., 1*s*. (London, Longman, 1868.)

Elements of Geometrical Drawing, by Thos. Bradley, in two parts, oblong folio, each 16*s*. (London, Chapman & Hall, 1862.)

Practical Geometry, Linear Perspective, and Projection, by Thos. Bradley (Library of Useful Knowledge), 8vo. (London, Baldwin.)

Elements of Descriptive Geometry, by J. Woolley, text 8vo., plates 4to., 20s. (London, Parker, 1850.)
Elementary Geometrical Drawing, by S. H. Winter, in two 8vo. parts, 3s. 6d. and 6s. 6d. (London, Longman, 1861.)
Elementary Treatise on Descriptive Geometry, by J. F. Heather, (Weale's series), 12mo., 2s. (London, Weale, 1851.)
First Lines in Geometrical Drawing, by J. F. H. De Rheims, 8vo., 9s. (London, Williams & Norgate, 1865.)
**Traité de Géométrie Descriptive*, par J. Adhémar (with Atlas), 8vo. 20s. (Paris, 4th ed.)
Essais de Géométrie sur les Plans et les Surfaces Courbes, par S. F. Lacroix. (Paris, 7th ed.)
Traité de Géométrie Descriptive, par Lefébure de Fourcy, 2 vols., 8vo. (Paris, 1864.)
Traité de Géométrie Descriptive, par La Vallée (with Atlas), 4to., 15s. (Paris, 2nd ed., 1825.)
Traité de Stéréotomie, &c., par C. F. A. Leroy, *annotée* par E. Martelet, 4to. (with Atlas in folio). (Paris, 1866.)
Notes et Croquis de Géométrie Descriptive, par Bardin, folio, 10s. (Paris, 2nd ed., 1837.)

SUBJECT II.—MACHINE CONSTRUCTION AND DRAWING.

First Stage or Elementary Course.

The candidate will have to draw from sketches and written conditions the elementary constituent parts of all mechanism, such as wheels, cams, links, cranks, couplings, shafting, excentrics, cushions, or pillow blocks, but he must show his knowledge of machinery by supplying those details and that finish of execution that are intentionally omitted in the sketch. Any indication in the candidate's work that he has simply copied the sketch, only altering the scale, without understanding the principle of the mechanism, will invalidate his examination.

The essential condition of *symmetry* which characterizes all the works of man, that of being counterpart on each side of a central line or axis of symmetry, indicates the proper mode of drawing such objects; this principle in drawing, which may be called "copying by co-ordinates," must be rigorously observed, not only in the general forms but even down to the smallest details; unless it is so the drawing must be worthless, because inaccurate.

Second Stage or Advanced Course.

The candidate will have to represent combinations of the above-named elementary parts in machinery, as engines, lathes, drilling, planing machines, tools, clock-work, &c. He will have unfinished sketches of such combinations set before him, and he will be expected occasionally to show the parts in that different position which would be produced by the motive power acting on mutually dependent parts.

He will also occasionally be required to show, in skeleton outline, new combinations for effecting some changes of motion and velocity according to conditions.

* The most practical of all French works.

He must also be able to represent parts of mechanism that admit of it in isometrical projection.

Examination for Honours.

The candidate will be required to make one or more drawings to scale of some machine intended to effect a prescribed operation, from a description, aided by sketches of those parts requiring especial explanation. These drawings he will be allowed to execute at his own home.

In addition he will have to answer in writing, and by sketches to scale illustrating his answers, questions on the general principles of mechanism, the modes of connecting the *power* with the *work*, the different modes of changing the velocity of the motions produced, and generally, analogous questions intended to ascertain his knowledge of machinery, and the means of representing it.

Works containing illustrations of engines, tools and machines are too numerous and well-known to require enumeration, but for the principles of mechanism, the following are particularly recommended :—

The Elements of Mechanism, by T. M. Goodeve, 8vo., 6*s*. 6*d*.
(London, Longman, 2nd ed., 1865.)

Dynamics, Construction of Machinery, by G. F. Warr, 8vo., 9*s*. 6*d*.
(London, Baldwin, 1851.)

SUBJECT III.—BUILDING CONSTRUCTION.

First Stage or Elementary Course.

The candidate will have to draw from unfinished sketches, as stated for the preceding subject, parts of constructions, such as walls, floors, roofs, partitions, arches, &c. The same remarks and injunctions apply here as for Subject No. II. In building construction the knowledge of the candidate will be shown by the bond of his brickwork, the framing and scantling of his timber, and joinery of his doors and sashes, and by the characteristic peculiarity of cast or wrought-iron structures.

Second Stage or Advanced Course.

The candidate will, in addition to more elaborate drawings of the same elementary parts, have to draw parts of viaducts, bridges, embankments, docks, &c. &c., and will have to answer, in writing, questions on the material, brick, stone, slate, timber, &c. used in such works.

In addition he will occasionally be called on to design parts of structures according to given conditions of use and material, but as the time allowed for the examination does not admit of any complicated drawing, he can only be expected to show his knowledge and taste by his drawing as far as it goes.

Examination for Honours.

The candidate will have to make one or more drawings of a building for some special use from description and specification, these drawings he will be allowed to execute at his own home. He will also have to

answer in writing, illustrated when directed by sketches to scale, questions on the following subjects :—

The different materials used in building, the mode of preparing them and their application in different parts.

The framing of timber in roofs, floors, partitions, stairs, &c.

The use of iron, cast or wrought; the construction of lattice girders in viaducts, bridges, &c.

The construction of brick, stone, or iron bridges, direct or oblique, suspension bridges, tunnels, drains, &c., &c.

Works containing examples of building construction are numerous. The following is recommended :—

Examples of Building Construction, by H. Laxton, in four parts, folio, each 2*l*. 10*s*. (London, 1856–62.)

SUBJECT III (ALTERNATIVE).—NAVAL ARCHITECTURE.

First Stage or Elementary Course.

Candidates for the elementary course will be required to possess sufficient knowledge of practical ship-building, to apply the various materials used for that purpose to the greatest advantage. Also to be able to make sketches, to scale, of the component parts of a ship's hull.

Second Stage or Advanced Course.

Candidates for the more advanced course will, in addition to that directed for the elementary course, be required to make detail and working drawings, showing a knowledge of the methods of combining the several parts of a ship's hull. Also to possess a knowledge of laying off on the mould loft floor.

Examination for Honours.

The honours examination will embrace questions relating to the calculation of displacement, in addition to that prescribed for the preceding courses; and the candidates will be required to make a drawing at home, comprising sheer, half-breadth and body plans, from data which will be furnished.

Neatness and accuracy in drawing will be insisted on.

The following works will comprise all that the teachers will require as text books, viz. :—

Rudiments of Naval Architecture, by James Peake (Weale's Series), 12mo., 3*s*. (London, Weale, 1851.)

Shipbuilding in Iron and Steel, by E. J. Reed, 8vo., 30*s*. (London, Murray, 1868.)

Directions for Laying-off Ships, by J. Fincham, 8vo., 25*s*. (London, Whittaker, 1840.)

Outline of Shipbuilding, by J. Fincham, 8vo., 31*s*. 6*d*. (London, Whittaker, 1853.)

Shipbuilding, Theoretical and Practical, edited by W. J. M. Rankine, folio, 84*s*. (London, Mackenzie, 1866.)

SUBJECT IV.—ELEMENTARY MATHEMATICS.

The questions which will be set in the two grades or stages of the class examination will be confined to the following subjects, and the answers which will ensure full marks must be given in accordance with the instructions annexed to each division.

1. *Arithmetic generally.*—The performance of numerical calculations with accuracy and lucid arrangement and explanation of the reasons of processes of a simple kind may be demanded. This branch is mentioned not so much as a separate subject, but because wherever examples are given which involve *numbers*, the complete solution in figures should be given: that it may be ascertained by the examiner that the candidate can from formulæ in symbols deduce useful numerical results.

   Decimal fractions in all cases to be shown (not *vulgar fractions*).
2. *Geometry.*—The properties of lines, triangles, rectilinear figures, the circle, properties of similar figures, inscribed and circumscribed polygons.

   The examination questions in this subject will generally be set in the words of Simson's Euclid, but any logical proof of a proposed theorem, or accurate solution of a problem, will receive full credit if it be clearly evident that the candidate has apprehended the course of reasoning which preceded the proposition. Candidates should endeavour to draw good figures, and should as much as possible keep the demonstration on the same page with the figure.
3. *Algebra.*—Definitions. Simple rules. Greatest common measure and least common multiple. Indices. Involution and Evolution. Simple equations and problems producing them. Fractions. Quadratic equations and problems producing them. Ratio. Proportion. Variation. Permutations and combinations. Progressions, arithmetical, geometrical, harmonical; and the binomial theorem for a positive integral index.
4. *Plane Trigonometry.*—Definitions. Conversion of degrees and their subdivisions into grades, and their subdivisions, and *vice versâ.* Angular and circular measures of degrees and their relation. The goniometric functions of angles and the conversion of one into another. The arithmetical values of the goniometric functions of 90°, 45°, 60°, 30°, 180°, 120°, 150°, &c. The meaning of contrariety of signs in trigonometry. Tracing of the goniometric functions in magnitude and algebraic sign through the four quadrants and when an angle is indefinitely increased.

   Formulæ for multiplication and division of angles, viz: sine, cosine, tangent, &c., of $(A \pm B)$, $2A$, $3A$, $\frac{A}{2}$, and $\frac{A}{3}$. Also of A and B in terms of $\frac{A+B}{2}$ and $\frac{A-B}{2}$.

   Logarithms.—Definition. Multiplication, Division, Involution and Evolution by logs. The use of logarithmic tables. Tables of proportional parts for numbers and angles. Modulus. Construction of logarithmic tables, and of tables of logarithmic sines, cosines, &c.

   Triangles.—Formulæ for cosine of an angle of a triangle in terms of its sides. The relation between sines of angles and the opposite

sides; sine, cosine, tangent, &c., of half an angle of a triangle in terms of sides, and of the sine of an angle. Area of a triangle. Solution of triangles. Diameters of circles inscribed in and circumscribed about a given triangle. Areas of regular polygons inscribed in and circumscribed about a given circle. Area of a circle. Description and use of vernier and theodolite and sextant. Heights and distances of inaccessible objects.

The extent of the examination is shown by the detailed particulars under each head.

First Stage, or Elementary Course.

In the first paper the questions will be restricted—

1. In geometry to the properties of lines, triangles, rectilinear figures, and the circle, (*i. e.* in the case of Euclid's elements not beyond the end of the third book).
2. In algebra, the subjects mentioned above up to and including simple equations and questions producing them, together with proportion and arithmetical and geometrical progressions.
3. *Trigonometry.*—The subjects mentioned before *logarithms.*
   Logarithms.—The use of logarithms and logarithmic tables only including the tables of proportional parts.
   Triangles.—The solution of right-angled triangles only, and such problems of heights and distances as depend only on the solution of right-angled triangles.

The lowest class of those who will be approved on this paper may be reached by students who know accurately the first book of Euclid, can solve simple equations, and can prove the formulæ for solution of right-angled triangles.

Second Stage, or Advanced Course.

In the second or advanced stage, the questions will go over the whole extent of the subject as set forth in the detailed syllabus given above.

Examination for Honours.

The range of subjects being the same, it will be proposed in this paper to place before the student questions which will be chiefly problems or theorems of the more difficult kind in each part. In algebra, the examples given will require more familiarity with the subject: in geometry, the questions will chiefly be deductions, or may require the aid of trigonometry as well as pure geometry for their complete answer: in trigonometry, besides questions which will exercise the student's ingenuity and test his familiarity with principles, the subject of angles greater than two right angles, and the relations between trigonometric ratios and all the angles which they indicate, will be included; trigonometric eliminations and transformations and the application of algebra to geometry must be familiar. (It is not meant by this that analytical geometry or the equations of the line and circle will be required, but chiefly the algebraic representation of geometrical ratios.)

The books in which elementary mathematics may be studied are too numerous to be mentioned, but as specimens of good and trustworthy treatises, which may be used with advantage by candidates who have little or no assistance, the following works by Mr. Todhunter may be recommended:—

Algebra for Beginners, 18mo., 2*s.* 6*d.*
(London, Macmillan, new ed., 1867.)

Algebra for the use of Colleges and Schools, 8vo., 7*s.* 6*d.*
(London, Macmillan, 4th ed., 1866.)

Trigonometry for Beginners, 18mo., 2*s.* 6*d.*
(London, Macmillan, 1866.)

Elements of Euclid, 18mo., 3*s.* 6*d.*
(London, Macmillan, new ed., 1864.)

Plane Trigonometry. 8vo. 5*s.* (London, Macmillan, 2nd ed., 1861.)

More advanced students may study with advantage :—

Wood's Elements of Algebra, by T. Lund, 8vo., 12*s.* 6*d.*
(London, Longman, new ed., 1861.)

which contains an abundant supply of examples in Algebra.

Also,—

Arithmetic and Algebra, by Barnard Smith, 8vo., 10*s.* 6*d.*
(London, Macmillan, 7th ed., 1860.)

may be found useful.

SUBJECT V.—HIGHER MATHEMATICS.

First Stage or Elementary Course.

1. *Algebra.*—Theory of indices (fractional and negative). Binomial theorem with fractional and negative indices. Interest, equation of payments, annuities. Multinomial theorem (integral exponent). Exponential theorem. Indeterminate equations and problems of the first degree. Indeterminate coefficients. Resolution of easy rational fractions into partial fractions. Scales of notations. To express numbers in different scales. Logarithmic series.
2. *Trigonometry.*—Demoivre's theorem for a positive integral index. To express the sine, cosine, and tangent of the sum of any number of angles in terms of the sines, cosines, and tangents of the simple angles. To express the sine, cosine, and tangent of a multiple angle in terms of the powers of the sine, cosine, and tangent of the angle. To express the powers of sine, cosine, and tangent of an angle in terms of the sines, cosines, &c., of the multiple angle. Expressions for sine, cosine, and tangent of an angle in terms of the angle.
3. *Spherical Trigonometry.*—Definitions and fundamental properties with regard to limits of values of sides and angles. To express the arc of a small circle in terms of the corresponding arc of a great circle. The polar or supplemental triangle and its properties. The area of a spherical triangle in terms of the angles (spherical excess). To prove that the sines of the angles are proportional to the sines of the opposite sides. To express the cosine of an angle in terms of the cosines and sines of the sides, and the cosine of a side in terms of cosines and sines of the angles. To express the relation between two sides and two angles, one of which is included by the sides (*e.g.*, $\text{Cot } a \text{ Sin } b = \text{Cos } b \text{ Cos C} + \text{Sin C Cot A}$). Solution of right-angled, quadrantal, and isosceles triangles.
4. *Co-ordinate Geometry and Conic Sections.*—Co-ordinates of a point. To express the area of a triangle in terms of the co-ordinates of the angular points. Locus of an equation. Equation to a curve.

Equation to a straight line in various forms referred to rectangular, oblique, and polar co-ordinates. Equation to a straight line through one or two points, or parallel to a given straight line. Co-ordinates of points of intersection of two or more straight lines.

To find the angle between two given straight lines, and the equation to a straight line perpendicular to a given straight line, or making a given angle with it. To find the length of the perpendicular let fall from a given point on a straight line. (Rectangular axes.)

Transformation of co-ordinates by changing the origin, by changing the direction of the axes, both rectangular and oblique, by changing rectangular to polar co-ordinates, and *vice versâ.*

The Circle.—Equations to the circle and to the tangent and normal of a circle at any point.

Parabola.—Definition, and equation referred to rectangular axes. To find the equation to the tangent and normal. To show that $SP = ST = SG$. To find the length of the perpendicular from the focus on the tangent.

Ellipse.—Definition and equations (rectangular axes). Directrices and foci. To express the focal distance in terms of the abscissa. The sum of the focal distances is equal to the axis major. The excentric angle. To express the co-ordinates of a point in terms of the excentric angle.

The equations to the tangent and normal. To show that $CT = \frac{CA^2}{CM}$, $CG = e^2CM$. The normal bisects the angle between the focal distances; the length of the perpendicular from the focus on the tangent.

Hyperbola.—Corresponding propositions to those for the ellipse. The equilateral or rectangular hyperbola.

5. *Differential Calculus.*—Definitions. Limit. Differential coefficient. Differential coefficients of sum, product, or quotient of functions.

To find the differential coefficients of x^n, a^x, $\log_a x$, $\sin x$, $\cos x$, $\tan x$, $\sec x$, $\cot x$, $\sec x$.

To find the differential coefficients of the inverse trigonometrical functions, *e.g.*, $\sin^{-1}x$, $\cos^{-1}x$, $\tan^{-1}x$, &c., and to find $\frac{du}{dx}$ when $u=f(y)$ and $y=F(x)$, with examples.

Expansion in series by Taylor's and Maclaurin's theorems with easy examples.

To find the limiting values of functions which assume an indeterminate form (easy vanishing fractions).

To determine the maxima and minima values of functions of one independent variable, with examples.

Tangents and normals to plane curves. Subtangent and subnormal.

6. *Integral Calculus.*—Meaning of integration. Elementary integrals. Integration of more simple rational fractions.

Second Stage, or Advanced Course.

In addition to the propositions in the elementary course given above, the candidate will be required to know the more advanced parts of the same subjects.

1. *Algebra.*—Multinomial theorem for negative and fractional exponents. Reversion of series. Continued fractions. Reduction of a quadratic surd to a continued fraction. Summation of series. Theory of

quadratic surds. Theory of numbers. Prime numbers. Forms of numbers. Fermat's theorem.

2. *Trigonometry.*—Demoivre's theorem with negative or fractional exponents. The exponential expressions for the sine, cosine, and tangent of an angle. Series by help of these expressions.

Solution of quadratic and cubic equations by trigonometry. Summation of series of sines, cosines of angles in arithmetic progression, and of other series dependent on these.

3. *Spherical Trigonometry.*—Napier's analogies and Gausse's formulæ, viz.:—

$$\text{Cos}\ \tfrac{1}{2}(\text{A}+\text{B})\ \text{Cos}\ \tfrac{1}{2}c=\text{Cos}\ \tfrac{1}{2}(a+b)\ \text{Sin}\ \tfrac{1}{2}\ \text{C}.$$
$$\text{Cos}\ \tfrac{1}{2}(\text{A}+\text{B})\ \text{Sin}\ \tfrac{1}{2}c=\text{Sin}\ \tfrac{1}{2}(a+b)\ \text{Sin}\ \tfrac{1}{2}\ \text{C}.$$
$$\text{Sin}\ \tfrac{1}{2}(\text{A}+\text{B})\ \text{Cos}\ \tfrac{1}{2}c=\text{Cos}\ \tfrac{1}{2}(a-b)\ \text{Cos}\ \tfrac{1}{2}\ \text{C}.$$
$$\text{Sin}\ \tfrac{1}{2}(\text{A}+\text{B})\ \text{Sin}\ \tfrac{1}{2}c=\text{Sin}\ \tfrac{1}{2}(a-b)\ \text{Cos}\ \tfrac{1}{2}\ \text{C}.$$

Solution of oblique-angled triangles and ambiguous cases. Spherical excess in terms of the sides of a triangle, &c. Radii of circles inscribed in and circumscribed about a spherical triangle.

4. *Co-ordinate Geometry.*—Angles between straight lines, perpendiculars on them, and length of perpendiculars referred to oblique axes. Polar equation to a straight line which passes through two given points.

Circle.—Chord of contact of tangents to a circle through an external point. Locus of intersection of tangents drawn at extremities of chords which pass through a fixed point. Circle referred to oblique and polar co-ordinates.

Parabola.—Chord of contact and problems depending on it. Locus of intersection of tangent with the perpendicular on it from the focus.

Diameters; their properties. Equation to the parabola referred to diameter and tangent at its extremity as axes. Tangents at the extremities of any chord of a parabola meet in the diameter which bisects that chord.

The parabola referred to polar co-ordinates. Properties connected with tangents drawn at the extremities of a focal chord. If through any points within or without a parabola, two lines be drawn parallel to two given straight lines to meet the curve, the rectangles of the segments will be to one another in an invariable ratio.

Ellipse.—Chords of contact. Conjugate diameters and their properties. Equation to ellipse referred to conjugate diameters as axes. Properties connected with tangents drawn at the extremities of a focal chord.

The ellipse referred to polar co-ordinates. If through any point within or without an ellipse two lines be drawn parallel to two given straight lines to meet the curve, the rectangles of the segments will be to one another in an invariable ratio.

Hyperbola.—Corresponding propositions to those for the ellipse. Conjugate hyperbola. Asymptotes. Equation to hyperbola referred to asymptotes as axes, to tangent, &c.

General Equation of Second Degree.—To show when it represents ellipse, hyperbola, parabola, circle, or two straight lines. The equation to a conic section referred to a pair of tangents as axes.

Sections of a right cone made by a plane perpendicular to a plane containing its axis.

5. *Differential Calculus.*

Successive differentiations of simple functions, and of the product of two functions (Leibnitz's theorem), with examples. Application of Taylor's and Maclaurin's theorems to more complicated

expansions. Differentiation of functions of two independent variables. If $y = z + x F(y)$ to expand $f(y)$ according to ascending powers of x (Lagrange's theorem).

Vanishing fractions (more complicated). Maxima and minima values of functions of two independent variables with examples. Differentiation of implicit functions. Elimination of constants or functions by differentiation.

Curves, asymptotes, tangents, and normals referred to polar co-ordinates. Polar subtangent; asymptotes referred to polar co-ordinates.

To determine whether a curve is concave or convex with respect to a given line: to find points of inflexion. Tracing of curves.

To find the differential coefficients of an arc, area, volume, and surface of revolution (rectangular and polar axes). Contact, circles of curvature and evolute.

6. *Integral Calculus.*

Formulæ of reduction. Integration between limits. Double integration.

Application to length and areas of curves and to volumes and surfaces of solids of revolution.

Examination for Honours.

In addition to the above:—

1. *Algebra.*—Convergency and divergency of series and recurring series. Indeterminate equations of a higher degree than the first.

   Properties of numbers. Wilson's theorem. To find the number of positive integers less than a given number and prime to it; number of divisors of a given number; number of ways into which a number can be resolved into its prime factors and polygonal numbers.
2. *Trigonometry.*—Construction of tables. Formulæ of verification. Proportional parts in logarithmic functions of angles.
3. *Spherical Trigonometry.*—Regular polyhedron, parallelopiped, and tetrahedron, with problems.
4. *Co-ordinate Geometry and Conic Sections.*—Problems in the straight line and circle. Radical axis, pole and polar. Supplemental chords to ellipse and hyperbola. Miscellaneous propositions. Similar curves. Anharmonic and harmonic pencils.
5. *Differential Calculus.*—Limits and failure of Taylor's theorem; Laplace's theorem.

   Second differentiation of implicit functions; change of the independent variable (1) when there is one independent variable, (2) when there are two independent variables.

   Maxima and minima values of functions of several independent variables.

   Curves. Singular points. Multiple points. Cusps, &c. Envelopes.
6. *Integral Calculus.*—Elliptic functions.

In preparing for examination in the courses described in the above Syllabus the student may use any standard works, and the following by Mr. Todhunter will be found especially useful:—

Algebra for Colleges and Schools, 8vo., 7*s.* 6*d.* (London, Macmillan, 4th ed., 1866.)
Conic Sections, 8vo., 7*s.* 6*d.* (London, Macmillan, 3rd ed., 1862.)
Plane Trigonometry, 8vo., 5*s.* (London, Macmillan, 2nd ed., 1861.)

Spherical Trigonometry, 8vo., 4*s*. 6*d*.
(London, Macmillan, 2nd ed., 1863.)
Treatise on the Differential Calculus, 8vo., 10*s*. 6*d*.
(London, Macmillan, 4th ed., 1865.)
On the Integral Calculus and its Application, 8vo., 10*s*. 6*d*.
(London, Macmillan, 2nd ed., 1857.)

SUBJECT VI.—THEORETICAL MECHANICS.

First Stage or Elementary Course.

The student who takes up this course is expected to give clear and full statements of the principles of the science, and to show that he understands them by answering easy questions on their applications. These questions will not demand for their solution a knowledge of mathematics beyond the elements of algebra, mensuration, and geometrical constructions by scales and compasses. The formal proof of theorems will not be required except in the cases specified below:—

A.—*Statics*.

(1.) The composition and resolution of forces and the conditions of their equilibrium, viz., the parallelogram, triangle, and polygon of forces. Parallel forces. Equivalence of two couples. Composition of a couple and a force. The principle of moments.
(2.) Physical properties of solids; hardness, elasticity, tenacity.
(3.) Centre of gravity. Its position in the case of a straight line, parallelogram, circle, triangle, sphere, pyramid, and cone, of uniform density; and in the case of several heavy points.
(4.) Reaction of a fixed point or fulcrum. Equilibrium of a body capable of turning round a fixed point; levers; the balance, and its sensibility; the steel-yard.
(5.) Transmission of force through a rigid body and through a perfectly flexible thread. The single pulley. Simpler combinations of pulleys.
(6.) Reaction of smooth and rough surfaces; the limiting angle of resistance, or angle of repose; the coefficient of friction; the laws of friction.
(7.) Conditions of equilibrium of a body resting under the action of forces on a plane whether smooth or rough, horizontal or inclined; equilibrium of a wall sustaining an oblique thrust; buttresses.
(8.) Stable and unstable equilibrium.
(9.) Unit of work, and horse power; simple questions as to the working power of agents; the modulus of a machine.

B.—*Dynamics*.

(1.) Measure of time, distance and velocity—uniform or variable. The accelerative effect of a constant force, and particularly that of gravity. Relations between space, velocity and time in the case of the rectilinear motion of bodies whose velocities are uniformly accelerated. Composition of velocities.
(2.) Definitions of mass, momentum, moving force and of vis viva, energy or accumulated work. The laws of motion. The absolute unit of force.

(3.) Rectilinear motion of a body under the action of given forces; Atwood's machine; motion on an inclined plane, and in a circle; centrifugal force; time of small oscillation of a simple pendulum. Centre of oscillation of an oscillating body.

(4.) Impulsive forces; velocity after direct impact of spheres; transformation (or loss) of accumulated work in collision.

C.—*Hydrostatics and Pneumatics.*

(1.) Law of transmission of pressure through a fluid; pressure of a fluid against a plane area; the centre of pressure; equilibrium of a reservoir wall.

(2.) Pressure of a fluid on a body wholly or partly immersed. Specific gravity of a solid or liquid; and the simpler cases of its determination. Conditions of equilibrium of a floating body. The metacentre. Conditions of stability of a floating body.

(3.) Experiments which show that air is an elastic fluid; the Magdeburg hemispheres; the cistern barometer; Boyle's experiment. Relation between pressure, temperature, and volume of a gas.

(4.) Well known machines and the principles of their construction; the hydraulic press; the specific gravity balance; the hydrometer; Nicholson's hydrometer; the specific gravity bottle; the ordinary suction and forcing pumps; the syphon; the air pump.

The student should be able, if required, to prove :—

(*a.*) The rule for determining the *magnitude* of the resultant of two intersecting forces, assuming the rule for its *direction*.

(*b.*) The rule for determining the resultant of two parallel forces.

(*c.*) That the sum of the moments of two intersecting forces with reference to any point in their plane, equals the moment of their resultant with respect to the same point.

(*d.*) That two couples acting in the same plane will be in equilibrium if their moments are equal and of contrary signs.

(*e.*) The rule for finding the centre of gravity of a triangle.

(*f.*) The formulæ for uniformly acclerated rectilinear motion, viz. :—

$$v = V + ft. \qquad s = Vt + \tfrac{1}{2}ft^2. \qquad v^2 = V^2 + 2fs.$$

(*g.*) The formula for the *vis viva* of, or *work accumulated* in a moving body, viz., $\frac{1}{2}mv^2$ or $\frac{wv^2}{2g}$.

(*h.*) That the pressure of a fluid on a body wholly or partly immersed equals the weight of the fluid displaced, and acts vertically upward through the centre of gravity of the immersed part of the body supposed of uniform density.

Second Stage or Advanced Course.

The student who takes up the second or advanced course is expected to be able to prove the fundamental theorems of mechanics, so far as the subject is included in the elementary course, and to work somewhat harder examples; thus :—In the elementary examination he might be asked to explain what is meant by "centrifugal force," and to work an easy example on the formula $F = \frac{mv^2}{r}$; in the advanced examination he might be asked to prove this formula as well as to work a somewhat harder example. He is also expected to pursue the subject into some of its leading developments.

(1.) Proof and applications of the equations of equilibrium of force acting in one plane.
(2.) Conditions of equilibrium of simple machines when the friction of the parts is taken into account. Inclined plane, wedge, screw, pulleys, bodies capable of turning round an axle of finite radius.
(3.) The principle of virtual velocities and its application to machines in a state of uniform motion. Dynamometers.
(4.) Motion on rough inclined and horizontal planes. Motion of projectiles.
(5.) Moment of inertia. Effective forces. D'Alembert's principle. Resultant of effective forces and work accumulated in the case of a body turning round a fixed line. The fly wheel. The compound pendulum.
(6.) Oblique impact. Centre of percussion. The ballistic pendulum.
(7.) Calculation of heights by barometer. The aneroid barometer.
(8.) Motion of fluids through orifices, pipes, and open channels.
(9.) Capillary attraction.

The following books are recommended for study; but it will, of course, be understood that all are not needed by any one student.

Elementary Treatise on Mechanics, by Wm. Whewell, 8vo., 9*s.* (London, Whittaker, 1847.)

Mechanics for Beginners, by I. Todhunter, 18mo., 4*s.* 6*d.* (London, Macmillan, 1867.)

Elementary Introduction to Practical Mechanics, by J. F. Twisden, 8vo., 10*s.* 6*d.* (London, Longman, 1867.)

Manual of Hydrostatics, by J. A. Galbraith and S. Haughton, 12mo., 2*s.* (London, Longman.)

Elementary Hydrostatics, by W. H. Besant, 12mo., 4*s.* (London, Bell and Daldy, 1867.)

Elementary Course of Mathematics, by Harvey Goodwin, 8vo., 16*s.* (London, Bell and Daldy, 6th ed., 1866.)

An Introduction to the study of Natural Philosophy, by C. Brooke, 12mo., 12*s.* 6*d.* (London, Churchill, 6th ed., 1867.)

Ganot's Experimental and Applied Physics, translated by E. Atkinson, 8vo., 15*s.* (London, Longman, 2nd ed., 1867.)

Examination for Honours.

The details of the course for this examination need not be specified, but it must be understood that the student should be prepared to answer questions on every branch of the subject as usually taught in the higher classes in colleges. In addition to the careful study of the usual text-books, such as Todhunter's *Analytical Statics*, Routh's or Griffin's *Rigid Dynamics*, Besant's or Miller's *Hydrostatics*, the student will find it very useful to study some work in which the subject is treated from a somewhat less exclusively mathematical point of view, such as the first 19 chapters of Jamin's *Cours de Physique*, Morin's *Notions fondamentales de Mécanique*, the first division of Thomson and Tait's *Natural Philosophy*, &c. The applications of abstract mechanics to questions of construction, &c. can be studied in Moseley's *Mechanical Principles of Engineering and Architecture*, and in Rankine's *Applied Mechanics*. It must be borne in mind that the study of the higher branches of mechanics can only be attempted with profit when it is preceded by a thorough knowledge of the elements; of so much, for instance, as is comprised in the first and second courses.

Particulars of the text-books required for this course are given below.

Analytical Statics with numerous examples, by I. Todhunter, 8vo., 10s. 6d. (London, Macmillan, 3rd ed., 1866.)

Dynamics of a System of Rigid Bodies, by E. J. Routh, 8vo., 10s. 6d. (London, Macmillan, 1860.)

Treatise on the Motion of a Rigid Body, by W. N. Griffin, 8vo., 6s. 6d. (London, Parker and Son, 1847.)

Treatise on Hydro Mechanics, by W. H. Besant, 8vo., 10s. 6d. (London, Bell and Daldy, 2nd ed., 1868.)

Elements of Hydrostatics and Hydrodynamics, by W. H. Miller, 8vo., 6s. (Cambridge, Deighton, 4th ed., 1850.)

Mechanical Principles of Engineering and Architecture, by H. Moseley, 8vo., 24s. (London, Longman, 1855.)

Manual of Applied Mechanics, by W. J. M. Rankine, 12s. 6d. (London, Griffin, 4th ed., 1868.)

Cours de Physique de l'Ecole Polytechnique, par J. Jamin, 3 vols., 8vo., 1l. 8s. 6d. (Paris, Mallet-Bachelier, 2nd ed., 1866–68.)

Leçons de Mécanique pratique, Notions fondamentales de Mécanique et données d'expérience, par A. Morin, 5 plates, 8vo., 6s. 6d. (Paris, Hachette, 3rd ed., 1860.)

SUBJECT VII.—MECHANICS AS AN ART, OR APPLIED MECHANICS.

The subject of applied mechanics is considered as embracing generally the art of fashioning materials into various definite forms, and of arranging these definite forms under such combinations that on the application of force a certain and invariable result will be obtained, including also the adaptation of forms and materials so that they afford the maximum resistance with the minimum of quantity.

This syllabus is arranged for three classes of candidates; the first is elementary in its character, and may be considered as a stepping-stone to the second or more advanced class; it is intended for the guidance of the first or elementary class of candidates, who will be expected to have a fair knowledge of most of the branches enumerated, and to be able to give a precise and satisfactory answer on any of them, or to make clear, well-drawn hand sketches where such may be necessary for explanation.

The second part is intended for those in the more advanced class, who will be expected to have a thorough knowledge of all the subjects referred to in the syllabus for the elementary class, and, in addition, to have a fair understanding of the application of the principles in actual practice.

The third part is intended for candidates coming forward for "Honours examination," who will be expected to have a complete knowledge of the questions referred to in the two former parts of the syllabus, and, in addition, to have some acquaintance with the higher theoretical principles that are required for the close investigation of the foregoing or more practical part of the subject.

As the chief object of these examinations is to foster the education of young men for the practical duties of life in connexion with the engineering and manufacturing industries of the kingdom, it is intended that the examination in applied mechanics shall be in accordance therewith so far as may be practicable.

First Stage or Elementary Course.

Candidates in the first stage will require to know the more prominent properties of materials used in the mechanical arts; the different natures of wood that are in common use; the leading characteristics of cast iron, wrought iron, and steel; copper, tin, and zinc; brass, gun metal, muntz metal, and other similar compounds used in machinery; leather, gutta-percha, and vulcanized india-rubber, as employed for mill bands or pump purposes.

The general principles on which various materials are made into form, by casting, forging, compressing, drawing, cutting, &c.; the purposes for which different materials are commonly employed and the reasons which determine their selection; the modes of uniting and combining the several parts of structures by screw bolts, rivets, keys, cotters, wedges, soldering, &c.

The general principles of mechanical work; units of work as distinguished from other units; unit of a horse power; the calculation of mechanical work; work of living agents, wind, water and steam, neglecting friction or other conditions.

The principle and construction of simple machines by the combination of several parts; levers, pulleys, wheel and axle, inclined planes, the wedge, screws. Likewise the more complex machines that are in common and extensive use; cranes that are worked by hand; the working headstock of a common turning lathe; the cornmill; the time movement of an ordinary clock, &c.

The more common methods of transmitting motion by simple elementary parts or apparatus in extensive use; toothed wheels considered as spur, bevil, mitre, worm, mangle, and eccentric; friction wheels, revolving shafts, couplings, bearings, drums, mill bands, fast and loose pulleys, conical pulleys for altering the rate of motion, clutches (forked and frictional); eccentric motion, camb motion, crank motion, reversing motion, intermittent motions; the pendulum, nature of a governor, cylinder and piston, slide valve, stuffing box, gland, fly wheel, safety valve, and other similar details.

Expenditure of work through the agency of machines; effect of reducing or increasing velocity; loss arising from friction. Calculating the power of simple machines, cranes, pulleys, screws, and their relative conditions in regard to friction; their applicability for different purposes.

General properties of fluid pressure, water pressure in tanks and on flood gates; weight of water; water power; power required to raise water; the principle of water forcing pumps and the Bramah press; hydraulic pressure, accumulator, pressure gauge, air pressure, weight of air, elasticity of air, air pump, barometer, aneroid, vacuum, vacuum gauge, syphon, and diving bell; action of the common household pump; condensation of air; the air gun; the balloon principle; effect of air pressure as regards sensible temperature, and contrary effect when liberated; Smith's bellows principle, and action of a blowing fan; principle on which chimneys produce a current of air; the blast pipe of locomotives; quantity of air required to produce the perfect combustion of fuel.

Three conditions of ice, water, and steam; sensible and latent heat; the several properties of steam taken advantage of in steam engines; action of steam in cylinder of steam engine; expansion of bodies by heat; the thermometer; heat conducting power of bodies; the advantage of covering steam pipes and cylinders with felt and other substances; principle of heating buildings by steam; water heating apparatus; difference between the evaporation of salt and fresh water.

Manufacturing as compared with making; principle of production by taking the pattern or figure from a copy; printing, coining, turning, and

planing; smiths' swages, and founders' patterns; conditions of a straight edge and of a true surface; the true spindle of a lathe; principles of an instrument for cutting, its penetration and strength. The action of the punch, file, saw, and grinding stone. The effect produced by plunging red hot steel into cold water; nature of tempering steel.

Strength of cast iron, wrought iron, and steel in regard to tenacity and compressibilty. Strength of a simple wooden beam under different conditions of support; supported at the ends and loaded in the middle; uniformly loaded. Nature of a neutral axis in beams; strength of beam as affected by length, depth, and thickness. Advantage of making cast-iron pillars hollow. Relative strength of chains to diameter of iron out of which they are made.

Second Stage or Advanced Course.

Candidates in the second stage require a general knowledge of the different kinds of timber used in the arts, including strength and special properties; the several metals employed in engineering, their nature, preparation, and special properties, including tenacity, compressibility, hardness, brittleness, density, malleability, ductility, elasticity, weight, specific weight, &c.

General principles of the art of founding; construction of patterns; essential conditions of a mould for the reception of liquid metal, &c. Chilled castings and malleable castings. Principles of smithing or forging; nature of welding; production of form by welding, upsetting, drawing down, punching, and bending. Steel management; temper of steel for different purposes; effect of cooling in oil, and case hardening. Principle of rolling iron, wire drawing, bolt and rivet making. Shearing machines, steam hammers, and drop hammers; principle of the bolt and nut. Rivetting by hand and by machinery. Nature of soldering; the essential principles involved.

Machines considered as agents for changing power from the unsuitable to the required condition, not creating power. Nature of friction; reduction of friction by lubricants; coefficients of friction of different materials and surfaces; laws of friction; friction as affected by the mode of transmitting power through machines; a given quantity of power expended under any conditions of velocity.

Lever principle applied in the arts; beams of steam engines; beams variously arranged as regards fulcrum. Cranes, crabs, or other machines for lifting where power is accumulated by toothed wheel gearing. The friction of cranes; arrangements to avoid friction; friction of block and tackle, ropes, and chains.

Inclined plane in the arts; friction of the inclined plane, as in the key for fixing parts of machinery; friction a virtue. Power required to draw materials up inclined planes. The screw as a fixing agent, and as an instrument for compressing, adjusting, dividing, and manipulating.

Regularity of motion necessary; power irregular, work done irregular. Use of the fly wheel; its power as depending on weight and velocity; efficiency depending on position; the fly wheel as an agent for storing power, as in the rolling mill and punching machine; fly wheel not increasing power. Steam hammers; springs considered as accumulators of power; means for setting machinery in motion gradually. Steam, water, fast and loose pulley; efficiency of friction clutches depending on an accumulation of small efforts; lowering goods with friction breaks on cranes, &c. Machinery which is regular in regard to time; theory of the pendulum and the governor; peculiar construction of water-wheel governors; comparison of the governor with the pendulum.

Machinery considered in relation to its three essential parts of the

receiving power, the so-called prime mover, the intermediate mechanism for conveying and modifying, the part which performs the required operation. The term "work" as expressing applied power, pressure, or distance. Mode of calculating the power of different kinds of machinery. Use of dynamometers, indicators, &c.

Machinery construction; strength with lightness; correct fitting of moving parts; principles that govern the formation of teeth of wheels. Advantage of wood and metal working together; velocity as depending on relative diameters; advantages derived from high velocities; construction of modern shafting and gearing generally, including all details. Best materials for bearings, both hard and soft; proportion of length to diameter; anti-frictional arrangements; broad surface advantages, &c.

Conveying work or power, by shafting or by endless bands; through a tube in the condition of compressed air, by water or steam; convenience in each case determining selection; respective advantages of the several methods. The leather band as an agent; its coefficient of friction, adhesion, adaptability for changing velocity, and efficiency as depending on velocity; various adaptations to convey power in different directions.

The advanced candidate should have precise knowledge of the different elementary mechanical contrivances for modifying motion. From fast to slow by the worm wheel, and by double and single and frictional ratchets. For changing from rotary into rectilinear or the reverse, by rack and pinion; by the crank motion as in steam engines, and the opposite, as in slotting machines; by an endless groove on cylinder; by screw with reversing motion. The mangle wheel principle, and three bevil wheel arrangement; open and crossed bands, with two fast and two loose pulleys. Contrivances for giving variable motion, such as the leather wheel on disc surface, the various forms of camb by which any motion may be obtained, &c.

Machinery construction considered with reference to form, proportion of parts, and strength of parts as determined by necessity; use of cast iron, limited by want of uniformity in cooling, of wrought iron by difficulty of fashioning into intricate form, and of bronze by cost; strength of revolving parts inversely as motion. The lever principle; advantage of fixing parts at both ends applied to pillars; risk of fracture reduced; advantages derived from hollow framing; stiffening by ribs; comparative cost of both systems. Form of parts as determined by the tenacity and compressibility of the materials, applied to beams; in machinery varied by other conditions causing inconsistencies of proportion; great advantage of rigid framing.

Strength of hollow cylinders not in proportion to mass; cylinder of hydraulic press, gun, &c.; each layer of lamina under tension affords greatest strength, the practical difficulties; system of building up cylinders by successive hoops, put on by pressure or by shrinking, each layer being under different tension.

The leading fundamental principles of pneumatics, with practical applications; apparatus for producing a current of air; blowing engines, and blowing apparatus generally; the fan principle, both in blowing and exhausting, with applications; mechanical ventilation of mines and buildings, as for example in cotton mills, and in the grinding processes.

Atmospheric elasticity and its applications in the post office atmospheric tube, flour mills, mines, atmospheric railways, engines working by compressed air; air vessels in pumping apparatus; cartridge, seamless bag, and envelope machine; button making; coal hewing; rock boring; dessicating timber.

The laws of hydrostatics and hydraulics, and their applications in the arts; ancient methods of raising water, modern steam pumping machinery; lifting, forcing, plunging, bucket, horizontal, vertical, centri-

fugal, screw, scoop, wheel, and other pumps; water supply to towns; sewerage pumping machinery; the syphon on a large scale; Middle Level drainage; Montgolfier water ram. Difference of friction with large or small pipes; flow of water through pipes; friction of mains; flow as affected by rust; high-pressure water machinery; provision for non-elasticity; working from high reservoir; water-pressure engines; character of pumps; boiler proving; application to hydraulic press, cranes, lifts, dock gates, capstan and bridges; rocket manufacture; water engines, &c.

Water as a motive power; water wheels and water engineering; making the most of fall; construction of dam, sluices, and canal; situation for factory; Fairbairn's water wheels, mode of transmitting the power; reduction of friction; modes of ascertaining the quantity of water available. Water power, nominal and actual; water acting by impulse and by weight; conditions determining greatest effect; manipulation of sluice by governor; water wheels coupled to steam engines, necessary provision; treatment of tidal water.

Gravitation water-pressure engines; various systems of construction of turbines and leading conditions to give best result; inherent defects, for high falls and for low falls; comparison with water wheels; useful effect, first cost, convenience and expense for repair; working in tail water; advantage from high velocity; equilibrium.

Engines deriving their power from heat, steam, hot air, and gas; the source of heat; the equivalent of work in heat; loss of heat by present arrangements; the heat contained in fuel. Steam boilers, in stationary, marine, and locomotive engines; materials for construction; strength of boilers for internal pressure; external pressure of elliptical or flat surfaces; boiler feeding by pumps and injectors; prevention of incrustation; explosion of boilers; general economy and management. Stationary, marine, locomotive, condensing, non-condensing, and working expansively steam engines; leading conditions that determine waste and economy; the principle of valves, slide, equilibrium, &c.; steam hammer construction.

Machine tools for wood: the principle of copying as developed in sawing, planing, morticing, tenoning, drilling, shaping, carving, and moulding gunstocks, &c. Machine tools for metal; combining the self-acting principle with that of the sliding rest; shape or form derived by transfer from a copy contained in the apparatus; the dead centre principle; modern lathes; machines for planing, slotting, drifting, shaping, screwing, wheel cutting, rifling, and drilling; advantage derived from introduction of true surface, and correct measurement of parts; measuring machine; principles which determine the proper speed for cutting wood and metal; machines that act more by force than by cutting, as the shearing and punching machines; the principle of circular shears, &c., various forms of screwing apparatus; advantage derived from uniform system of screws.

General machinery: hand, steam, travelling, and portable cranes; derrick and sheer legs. Paper manufacture, printing, and coining. Textile manufactures; carding, spinning, weaving, and sewing. Measuring. Turntables and weighing machines. Agricultural machinery and engines; steam plough; reaping and thrashing machines; modern grinding mills; traction engines.

Adaptation of form and material for maximum resistance; cast iron and wrought iron beams; tubular girders; construction of roofs, timber bridges; suspension bridges; iron pillars. Construction of tanks, strength of cast-iron pipes; hydraulic press cylinders; relation of ultimate strength of materials to limit of elasticity and safe working load.

Examination for Honours.

The foregoing syllabus will sufficiently indicate the nature of subjects that will form the basis for the Examination in Honours in Applied Mechanics. It will be expected however; that the candidate in addition to being able to give an intelligent answer to the various questions, and to make hand sketches of such parts as may be required, shall be thoroughly grounded in the laws of nature, so far as they relate to the philosophical and mathematical principles on which the various branches of applied mechanics are founded, and the candidate should not only be familiar with the formulæ, but should be able to refer back to the data from which they are derived.

The following are recommended as text books :—

The Elements of Mechanism, by Thomas Baker, 8vo., 2*s*. 6*d*. (London, Weale, 3rd ed., 1867.)

Elementary Introduction to Practical Mechanics, by J. F. Twisden, 8vo., 10*s*. 6*d*. (London, Longman, 1867.)

The Elements of Mechanism, by T. M. Goodeve, 8vo., 6*s*. 6*d*. (London, Longman, 2nd ed., 1865.)

Railway Locomotives, by D. K. Clark, 2 vols., 4to., 70*s*. (Glasgow, Blackie, 1860.)

Treatise on the Steam Engine, by J. Bourne, 4to., 42*s*. (London, Longman, 5th ed., 1861.)

Railway Practice, with Plans and Details, by S. C. Breeze, 4 vols., 4to., each 52*s*. 6*d*. (London, Atchley, 1848.)

Camus' Treatise on the Teeth of Wheels, by Hawkins, 8vo., 5*s*. (London, Spon, 3rd ed., 1868.)

Elementary Principles of Carpentry, by Thos. Tredgold, edited by Barlow, with 53 engravings, 4to., 2*l*. 2*s*. (London, Lockwood, 1868.)

Inquiry and Experiments on the Tensile Strength of Wrought Iron and Steel, by D. Kirkaldy, 8vo., 18*s*. (London, Simpkin, 2nd ed., 1866.)

Useful Information for Engineers, by W. Fairbairn, 3 vols., 8vo., 10*s*. 6*d*. each. (London, Longman, 1864.)

Turning and Mechanical Manipulation, by C. Holtzapffel, 3 vols., 8vo., 2*l*. 10*s*. (London, 1866.)

Engineer's and Machinist's Assistant, 2 vols., 4to., 4*l*. 4*s*. (Glasgow, Blackie, new ed., 1860.)

Engineer and Machinist's Drawing Book, 4to., 2*l*. 2*s*. (Glasgow, Blackie, new ed., 1868.)

Useful Metals and their Alloys, by Fairbairn, Scoffern, &c., 8vo., 7*s*. 6*d*. (London, Houlston, 4th ed., 1866.)

Moulders' and Founders' Pocket Guide, by F. Overman, 12mo., 4*s*. 6*d*. (Philadelphia, 2nd ed., 1866.)

On the Management of Steel, by G. Ede, 8vo., 5*s*. (London, Tweedie, 4th ed., 1866.)

In addition all the books bearing on this subject in *Weale's Series* may be recommended.

SUBJECT VIII.—ACOUSTICS, LIGHT AND HEAT.

First Stage or Elementary Course.

Questions will be confined to the following subjects:—

Acoustics.

The pupil ought to have a perfectly clear notion of the manner in which a *wave* is propagated.

He ought to know what is meant by the terms density and elasticity as applied to air and other bodies, and how heat and cold affect the density and elasticity of air.

He ought to be able to describe simple experiments to prove that air possesses both weight and elasticity. He ought to understand the law of Marriotte, the construction and use of the air pump, and what occurs when a sounding body is placed in a space from which the air has been withdrawn.

He ought to be taught to see the play of elasticity in the propagation of a sonorous wave through air, and to have a clear mental image of the condensation and rarefaction which make up such a wave. He must, of course, be able to distinguish between the motion of a wave and the motion of the particles which at any moment form the wave.

He ought to know how the velocity of a wave is affected by a change of density, by a change of elasticity, or by a change of both.

He ought to know the velocity of sound in air of the freezing temperature, and also the amount of augmentation of velocity for every degree of the thermometer. The temperature of the air being given, he ought to be able to calculate the velocity of sound through it, and the velocity of sound being given he ought to be able to calculate the temperature of the air.

No doubt or confusion must rest within his mind regarding the meaning of the terms *velocity*, *intensity*, and *amplitude*. He ought also to know the relation of the two last to each other.

He ought to know the laws of the reflection of sound by tubes and mirrors, and to be able to apply his knowledge to the explanation of echoes.

The law of inverse squares as applied to sound, ought also to be explained to the pupil.

He ought to be able to figure mentally the propagation of a sound-wave through solids and liquids as clearly as through air; to know the velocity of sound through water, and to be able to infer from this the relation of the density of the liquid to its elasticity.

He ought to know how the velocity of sound through air has been determined, and to be well exercised in the calculation of distances by means of light and sound.

The pupil ought to know the physical difference between music and noise, and to be able to state the conditions on which the pitch and the intensity of musical sounds depend. He ought also to be able to describe various methods of producing musical sounds.

He ought to have clear ideas of the *length* of a wave, and of the *time* of a vibration. The length of a wave at a definite temperature being given he ought to be able to calculate the time of a vibration, and the time of a vibration being given he ought to be able to calculate the length of the wave.

He ought to be able to describe a method of determining from the pitch of a sound the number of vibrations per second which produce it.

He ought to know the structure of the drum of the ear, including the membranes that close it, and the bones that cross it.

He ought to know the laws of the vibration of strings, and to understand the use of sound boards in stringed instruments.

He must have a clear notion of the formation of *nodes* upon a string, by the coalescence of direct and reflected waves.

He ought also to know the laws of vibration of columns of air in both stopped and open pipes. The exact condition of the air when the fundamental notes of each class of pipes is sounded, ought to be clearly present in the pupil's mind.

The cause of beats in music ought also to be explained to the pupil, and he ought to know the range of the human ear for musical sounds.

Light.

Before entering upon the subject of light, the teacher will have been careful to make his pupil perfectly familiar with the conception of waves of sound impinging upon the tympanic membrane, and the transmission of the tremor thus produced to the auditory nerve. He need not attempt to enter upon the details of this transference to the nerve, but up to the tympanic membrane, and including it, the idea formed by the pupil of sound waves and their action must be perfectly distinct. In all cases an image must exist corresponding to the teacher's words.

He must understand that the sensation of light is caused by something that hits the optic nerve. That this something, whatever it be, passes through the humours of the eye to reach the nerve behind. The conception of light known as the emission theory can afterwards be made clear to the pupil. According to this theory a ray of light would be a train of these particles.

That a ray of light proceeds in a straight line must be made known to the pupil. In connection with this point the inversion of objects by rays passing through small apertures must be explained.

The mode of determining the velocity of light by the eclipses of Jupiter's satellites must be explained to the pupil.

The law of inverse squares must be illustrated.

The cause of shadows and penumbræ must be explained.

The mode of determining the relative intensities of two lights by means of the "shadow test" must be explained.

The reflection of light from plane mirrors must be explained.

The pupil's attention must be drawn to the lateral inversion of objects by plane mirrors. He must know how the distance of an image behind a looking glass is affected by a change of position of the glass in a direction perpendicular to its own planes.

The relation between the angular velocity of a reflected ray and the mirror that reflects it must be explained to the pupil. The multiplication of images by angular mirrors ought also to be explained, and from it the appearances of the kaleidoscope rendered intelligible.

The formation of images by a concave spherical mirror ought to be explained to the pupil. The axis, principal focus, and centre of the mirror are to be pointed out. Beginning with a luminous point placed beyond the centre, and upon the axis, the successive positions of the image of this point during its motion along the axis from a great distance through the centre through the principal focus, up to the surface of the mirror itself must be determinable by the pupil. He will then be taught to determine the position of the images of points not placed on the axis. Objects of sensible dimensions, such as the pupil's own body, must then be substituted for points. (The teacher will avail himself of such simple apparatus as he can command in the explanations

here referred to; a silver spoon, if he possesses nothing better, will be useful).

Real and *virtual foci* are to be defined.

The "aberration" of a large spherical mirror must be explained.

The refraction of light must be explained. By means of a simple geometrical construction the meaning of the "index of refraction" may be explained to the pupil without the introduction of the term "sine."

It must be clearly explained that an object looked at with a single eye appears more near the greater the divergence is of the rays which reach the eye from the various points of the object. From this it will be inferred that a lake or river, the bottom of which is visible, appears more shallow than it really is.

Various simple, but instructive illustrations of the effects of refraction will occur to the teacher, such, for example, as the rendering of a coin visible by pouring water into a basin, and the apparent bending of a straight stick thrust obliquely into water.

The circumstances under which *total reflection* occurs must be clearly explained to the pupil.

The power and action of lenses must be explained; the teacher will define the *principal focus* of a lens. As in the case of a spherical mirror, he will begin with a luminous point, determining the position and character of its image, while it moves from a great distance up to the lens itself. He will pass from points to objects of sensible dimensions, and show how the position of the image of every point of such object may be determined.

Here also *real* and *virtual foci* are to be explained.

The explanation of the magic lantern is then to be introduced.

It would add much to the efficiency of the instruction if the teacher would illustrate the points here referred to by common spectacle lenses, provided he has nothing better.

The pupil in the first class is also in a condition to know what is meant by the spherical aberration of a lens.

He must understand the optical structure of the eye, be able to give a clear account of the conditions of distinct vision, and of the causes and remedies of long and short sight.

He ought to be acquainted with the fact that impressions persist upon the retina, and to know what is meant by irradiation.

He ought to know the principles of binocular vision, and to clearly comprehend how the impression of solidity is produced by the stereoscope.

He ought to be made acquainted with the composite character of white light; and to be able to describe an experiment by which such light may be resolved into its coloured constituents.

He ought to understand the doctrine of colours as far as they are produced by absorption.

And he ought to understand the meaning of *chromatic aberration.*

Finally, it is to be stated to the pupil that according to our best knowledge the sensation of light is not produced by the impact of little particles darted out from luminous bodies; but that it is caused in a manner somewhat similar to the sensation of sound, namely, by the successive shocks of minute waves against the retina.

Heat.

The pupil should know the general effect of heat upon the volumes of bodies, and should be able to describe experiments illustrative of the expansion of solids by heat. He ought also to have an idea of the almost irresistible force of this expansion.

He ought to understand with perfect clearness what is meant by the *coefficient of expansion*, linear, superficial, and cubical.

He ought to know by heart the coefficients of expansion of gold, silver, platinum, iron, and glass; and the reason why it is possible to fuse platinum wire into glass without fracture on cooling.

He ought to know the principle of Breguet's metallic thermometer, and to be made acquainted with some of the precautions which changes of volume by heat and cold render necessary in the arts.

He ought to be able to describe and explain the gridiron pendulum.

He must be able to describe the construction and explain the use of of the mercurial thermometer; the scales of Fahrenheit, Celsius, and Reaumur must be known to him, and he must be able to convert immediately the readings of any one of them into those of the other.

The dependence of the boiling point of water upon external pressure ought to be known, and the pupil must be able to give illustrations of this dependence.

He ought to know by heart the coefficients of expansion of water, alcohol, and mercury.

The pupil must be well acquainted with what is called the *maximum density* of water, to state at what temperature it occurs, and to point out its effects in nature.

He ought to be acquainted with the change of volume which occurs when water passes from the liquid to the solid state, and to apply his knowledge to the bursting of water-pipes in frosty weather. He ought to be acquainted with the fact that expansion on solidification is not a property peculiar to water.

He ought to be able to describe experiments which shall illustrate the expansion of gases. The principle and action of the fire-balloon ought to be explained to the pupil.

The general principles of ventilation ought also to be known to him, and also the sun's action in the generation of winds. He ought to be able to explain the Trade Winds.

The constancy of the coefficient of expansion of gases ought to be pointed out, with the small deviations from the general rule exhibited by carbonic and sulphurous acids. The chemical and physical character of these gases ought to be known to the pupil.

He ought to know the constitution, chemical and physical, of aqueous vapour, and how it is diffused in the atmosphere. He ought to know the meaning of the term *saturated* as applied to air charged with vapour.

The effect of expansion in chilling air ought to be known to the pupil, and also the condensation of the aqueous vapour diffused through the air in consequence of such a chill.

He ought to be able to see the application of this knowledge to the explanation of clouds and rain.

He ought to have a perfectly clear idea of what is meant by *specific heat* or *capacity for heat*, and to be able to describe the calorimeter of Lavoisier and Laplace. He ought to know by heart the specific heats of water, alcohol, mercury, iron, and lead; and to be made aware of the influence which the high specific heat of water exercises upon climate.

He ought also to be intimately acquainted with the facts covered by the term *latent heat*. Taking a block of ice at a temperature below the freezing point, he ought to be able to describe with perfect accuracy what occurs when the temperature of the substance is raised until it liquifies, boils, and is converted into vapour.

The latent heat of water, as expressed on the Fahrenheit and centigrade scales, ought to be in the pupil's memory.

The cold of evaporation and its effect in freezing water in the cryophorus ought to be known to the pupil.

He ought to be exercised in calculations on the changes of temperature due to the mixture of steam and water in various proportions.

The pupil ought to know what is meant by the *conduction* of heat, and must be able clearly to distinguish it from the distribution of heat by *convection*. He ought to know by heart the numbers expressing the relative conductivity of gold, silver, copper, iron, and lead.

He ought to be acquainted with the low power of conduction of organic substances; to know the effect of mechanical texture on the transmission of heat, and to explain the function of clothes in preserving the body from cold.

He ought to be acquainted with the character and phenomena of combustion; to be able to explain the chemical actions which occur in the combustion of coal and of ordinary gas, and to explain the manner in which a candle flame receives its supply of combustible matter.

The combustion of the diamond and Newton's prediction regarding it ought to be known to the pupil. That animal heat is due to slow combustion ought also to be made known.

The structure of an ordinary gas flame ought to be pointed out, and the cause of the difference between this flame and that of a Bunsen's burner explained.

The pupil must be acquainted with the general phenomena of *radiant heat*. The similarity between the phenomena of radiant heat and those of light, as regards reflection and refraction, ought to be known to the pupil.

The different powers possessed by different substances to radiate heat ought to be pointed out, and this knowledge ought to be applied in explaining the striking fact that the cooling of a vessel may, under certain circumstances, be hastened by surrounding it with flannel.

The reciprocity of radiation and absorption ought to be known to the pupil.

He ought also to know what is meant by the term *diathermancy*, and to be able to point how this property is manifested by different bodies.

Second Stage or Advanced Course.

Questions may be set in all Subjects enumerated under the Elementary Stage, and in addition on the following topics:—

Acoustics.

The second course in acoustics includes an intimate knowledge of all the subjects mentioned in the first. In addition to this a knowledge of the following subjects will be required:—

The augmentation of the velocity of propagation of a wave of sound through air by the condensation and rarefaction of the sound wave itself.

Harmonic tones, their generation and their function in music.

The laws which regulate the transverse vibrations of rods.

The vibrations possible to a tuning fork, a disk, and a bell.

The formation of Chladni's figures.

The laws which regulate the longitudinal vibrations of strings and rods. By a comparison of the notes emitted by a rod and a column of air the pupil ought to be able to determine the relative velocities of sound through both substances.

The conditions and cause of resonance ought to be known to the pupil.

He ought also to know how sounds are produced by the vocal organs of man, and to see clearly the similarity between such sounds and

those of the syren. As a case of the same kind, the construction and explanation of the Eolian harp ought also to be known to the pupil.

He ought to be well acquainted with the principles of interference as applied to sound.

He ought to be acquainted with the principles of harmony, to know the ratios of the vibrations corresponding to the notes of the gamut, to be able to give a clear account of the bearing of interference upon the question of consonance or dissonance, and to explain why those ratios which are represented by small whole numbers correspond to the most perfect harmony.

Light.

The candidate in the second course must be intimately acquainted with all the subjects mentioned in the first.

He must be able to apply his knowledge of total reflection to the explanation of the mirage of the desert.

He must be able to describe experiments by which white light may be produced by the admixture of its constituents.

He must know what is meant by *achromatism*.

He must be able to give a clear description of the undulatory theory, and to state how the colours of the spectrum are accounted for by that theory.

He must be able to define a ray of light in accordance with the undulatory theory.

He must be able to show how the reflection and refraction of light occur according to the undulatory theory.

He must be able to describe the appearances presented when incandescent metallic vapours are analysed by the prism. Especially must he be able to state what occurs when a sodium flame is thus analysed.

He must also be able to state what occurs when white light is transmitted through a sodium flame, and he must be able to describe an experiment which shall render manifest what occurs.

He must be able to state generally the relation that subsists between radiation and absorption by gases and vapours.

The lines of Fraunhofer must be known to the pupil, and from this knowledge in conjunction with the knowledge demanded by the foregoing paragraphs, he must be able to infer the probable constitution of the sun.

The pupil ought also to know the principles of interference as applied to light.

He ought to be able, in accordance with these principles, to account for the colours of thin plates and of striated surfaces.

The general principles of diffraction ought to be known to the pupil.

He ought to know what is meant by plane polarised light; to describe the act of polarisation in the language of the undulatory theory.

He ought to know what occurs when a beam of light is transmitted through a crystal of Iceland spar; and to describe the state of the emergent light as regards polarisation.

He ought to be able to describe the effects observed when light is transmitted through two plates of tourmaline cut parallel to the axis of the crystal.

He ought to be able to describe some form of the polariscope, and to state and explain by the principles of interference what occurs when a thin plate of selenite is placed between the polariser and analyser.

Heat.

The candidate in the second course must be intimately acquainted with all the subjects introduced into the first.

He ought to be able to give a clear statement of the *mechanical theory* of heat as distinguished from the *material theory*.

He must know what is meant by the "mechanical equivalent of heat," and how it has been determined.

He must know what is meant by specific heat at constant volume and at constant pressure, and to have in his memory the numerical ratio of the two specific heats.

He ought to be able not only to explain the meaning of the difference between the two specific heats in accordance with the mechanical theory, but also to show how from this ratio the mechanical equivalent of heat may be determined.

Given the weight and velocity of a moving body he ought to be able to calculate the amount of heat generated by the stoppage of the motion.

He ought to be able to apply the conceptions of the mechanical theory to the phenomena of combustion.

He ought also to be able to show the bearing of the theory upon the phenomena of specific and latent heat.

Examination for Honours.

The candidate for honours must be intimately acquainted with the foregoing two courses. He must also show himself practically acquainted with the apparatus employed in acoustics, light, and heat.

The following are recommended as text books:—

The Elements of Natural Philosophy, by C. Brooke and Golding Bird, 12mo., 12*s*. 6*d*. (London, Churchill, 6th ed., 1867.)

Ganot's experimental and Applied Physics, translated by E. Atkinson, 8vo., 15*s*. (London, Longman, 2nd ed., 1867.)

Handbook of Natural Philosophy, by D. Lardner. 4 vols., 12mo., 20*s*. (London, Walton, 1856.)

Elementary Treatise on Heat, by Balfour Stewart, 12mo., 7*s*. 6*d*. (London, Macmillan, 1866.)

Heat a Mode of Motion, by J. Tyndall, 8vo., 10*s*. 6*d*. (London, Longman, 3rd ed., 1868.)

A Course of Eight Lectures on Sound, by J. Tyndall, 8vo., 9*s*. (London, Longman, 1867.)

SUBJECT IX.—MAGNETISM AND ELECTRICITY.

First Stage or Elementary Course.

Magnetism.

It is exceedingly desirable that the pupil's ideas of the fundamental facts and principles of magnetism should be as clear as our knowledge and his capacity can make them.

He ought to be made acquainted with the action of the natural magnet or loadstone on small pieces of iron. This is to be mentioned to him as the first fact observed, but for the explanation of which other facts are necessary. The action of two natural magnets upon each other ought to be described, and through this action a clear notion of the doctrine of *magnetic polarity* ought to be conveyed to the pupil's mind.

The power of the natural magnet to confer its own magnetic properties

upon steel, and the action of the natural magnet on the steel which it has magnetised, ought to be explained.

The action of two pieces of magnetised steel upon each other ought to be made clear, and from this action the fundamental law that like poles repel each other, and that unlike poles attract each other, ought to be deduced.

The distribution of magnetism in a bar magnet ought to be made clear. The effect of breaking the magnet into two halves; the effect of again breaking these halves; and through facts of this nature, a clear idea is to be conveyed that each molecule of the magnet is itself a magnet; the action of the magnet as a whole being the sum of the actions of its molecules.

It is of exceeding importance that the pupil should be taught to connect the facts of magnetism by means of the provisional conception known as *the theory of magnetic fluids*. The teacher will assure himself that a correct image of this theory is in the pupil's mind. He will at the same time be careful to inform the pupil that the theory is an image merely, which enables him to connect and classify his facts, and that it is not a proved scientific truth.

The theory is to be applied in explaining the difference between iron and steel as regards their power of accepting and retaining magnetism. The term *coercive force* and all that relates to it will here come under review.

The theory is also to be applied in explaining the first observed facts of magnetism, including in them, and illustrating by them the general phenomena of magnetic induction, or magnetisation by influence. Every student ought to have a clear image of the state of a piece of iron acted on by a magnet, and he ought to be able to explain why the attraction of the iron is a consequence of that state. He ought clearly to see that repulsion as well as attraction is at work, the resultant attraction being the difference of both.

He ought to understand that when the attracting magnet is very distant, the difference between attraction and repulsion is so small as to be imperceptible; this knowledge will render it easy for him to comprehend why the magnetic poles of the earth which give *direction* to a magnetic needle are incompetent to produce a motion of translation.

The pupil ought to know the facts of terrestrial magnetism; why it is that we consider the earth a magnet. It will be possible to make him acquainted with all that is known regarding the position of the earth's magnetic equator and of the terrestrial magnetic poles.

The terms declination (variation), inclination (dip), and magnetic intensity, ought to be explained to him.

Frictional Electricity.

Here also care must be taken to imprint the fundamental facts and principles clearly and firmly upon the pupil's mind. It is easy in the case of frictional electricity to let the pupil actually see some of the facts; and it is exceedingly desirable that he should do so. The same remark applies to the elementary facts of magnetism.

As in the case of magnetism, the fact first observed, namely, the attraction of light bodies by rubbed amber, must be shown to need other facts for its explanation.

The mode of exciting bodies by friction is to be described; the action of rubbed and unrubbed vitreous bodies upon each other; the action of rubbed and unrubbed resinous bodies upon each other; and the action of vitreous bodies upon resinous bodies, and the reverse, are to be clearly described and illustrated. From these facts the law is to be deduced

that bodies similarly electrified repel, and dissimilarly electrified attract, each other. The pupil ought to know why the terms vitreous and resinous, as applied to electricity, have been abandoned.

Having been made acquainted with the elementary facts and principles, the pupil is to be rendered familiar with the provisional conception called the theory of electric fluids. As in the case of magnetism, he is to understand that this theory is an image merely, and not a truth.

He ought to be made acquainted, by experiments performed or described, with the qualities of insulation and conduction. He ought to know the reason of the old division of bodies into electrics and non-electrics, and also the unsound character of this classification.

Clear definitions ought to be given as to what is to be understood by positive and what by negative electricity. The pupil must be able to determine the quality of the electricity with which any body is charged.

He must be thoroughly versed in the phenomena of electric induction, and must be able to apply the theory of electric fluids in the explanation of these phenomena. In connexion with the subject of electricity this is the most important part of the teacher's duty, for upon a knowledge of the facts and principles of electric induction the comprehension of almost all that follows it depends.

The pupil ought to be able to construct, or describe the construction, of an electrophorus, and to explain its action by reference to the principles of electric induction.

He ought to be able to explain the condenser by reference to the same principles.

He ought to be able to explain the charging and discharging of the Leyden jar by reference to the same principles.

He ought to be able to describe the charging of the prime conductor of an electric machine by reference to the same principles.

The knowledge implied in the last three questions embraces that of the construction of the condenser, the Leyden jar, and the electric machine. The first form of the Leyden jar ought to be known to the pupil.

The distribution of electricity on the surfaces of conductors is to be made known, and from it the power of points to disperse electricity ought to be deduced. The pupil ought to realise that in virtue of its self-repelling character an electric fluid always moves to the external surfaces of bodies. The power of flames in dispersing electricity ought also to be made known to the pupil.

He will now be ready to understand the form and theory of lightning conductors.

The physiological, deflagrating, and mechanical effects of the electric discharge ought to be known to the pupil. He ought also to be able to apply his knowledge to the explanation of thunder and lightning, and of the return shock.

Voltaic Electricity.

The simplest combinations for the generation of a voltaic current ought to be made known to the pupil. The electric state of the free ends of the two metals immersed in the exciting liquid ought to be described; he ought to be taught to apply the theory of electric fluids to the conception of two currents flowing in opposite directions, and then the omission of one of these currents as a matter of convenience ought to be made known.

It is very important that the pupil should have a clear physical image of the fundamental phenomena before his mind. As in cases formerly referred to, the teacher will be careful to explain that this

idea of a fluid flowing in a current is an image merely, and not a proved truth.

Galvani's experiment with the legs of the frog which he suspended by a copper hook on an iron railing ought to be explained; and also the experiment of Sulzer, where the tongue is placed between two metals.

The bearing of the experiment illustrating "the return shock" on Galvani's first observation ought to be explained.

The idea of an electro-motive force separating the two electricities and driving them in opposite directions ought to be distinct in the pupil's mind.

He ought to be made acquainted with the magnetical effects of the circuit, with the action of a current upon iron filings, with its action upon a freely suspended magnetic needle. In this latter action he is to be particularly well versed, so as to be able immediately from the deflection of the needle to infer the direction of the current, and from the direction of the current the deflection of the needle.

He must know the action of a current upon a bar of iron placed within a coil round which a current circulates. He must understand the magnetic properties both of the coil and of the bar.

He ought to be made acquainted with the simplest form of the multiplying galvanometer.

He ought to understand the principles of the needle telegraph.

Some of the chemical effects of the current ought to be made known to the pupil. He ought, for example, to have a distinct notion of the composition of water, and an equally distinct notion of its decomposition by the electric current.

Second Stage or Advanced Course.

Magnetism.

The more advanced pupils that undertake the second course ought to be intimately acquainted with all the subjects introduced into the first. The following additional subjects are to be mastered.

The disposition of the so-called magnetic curves round a bar magnet, round two bar magnets with similar or unlike poles adjacent to each other, and round a horse-shoe magnet, must be clearly understood. The pupil must know how a short magnetic needle, or of a short bar of iron freely suspended acts in relation to those lines, and he must be able to show that the lines are deducible from the doctrine of magnetic polarity combined with elementary mechanical conceptions.

He must be able to figure mentally the magnetic curves of the earth, and to see their relation to the line of dip.

He must have perfectly clear notions as to what is meant by the strength of a magnet. He must be able to compare the strength of magnets together, by the method of oscillation, by the torsion balance, or by the deflection of a small magnetic needle.

A knowledge of the principles and use of the torsion balance is quite essential.

He must know what is meant by the law of inverse squares, and be able to show how it has been experimentally demonstrated.

The pupil must be acquainted with the effect of temperature and of percussion upon a magnet.

He must know the meaning of the terms horizontal intensity, vertical intensity, and total force. He ought also to know what is meant by the variation of all of those, that they are different at different parts of the earth's surface, at different hours of the day, at different seasons of the

year. To a knowledge of the diurnal and annual variations, he ought to add a knowledge of the secular variation.

Frictional Electricity.

The more advanced pupil must be intimately acquainted with all the subjects introduced into the first course.

He must understand the cascade arrangement of the Leyden battery, as contrasted with the ordinary arrangement.

He must understand the application of the torsion balance to the measurement of electric force.

He ought to be able to think out and describe various new and simple forms of the condenser and the Leyden jar.

He ought to be able to carry forward the idea of an electric fluid to the conception of a current of such fluid; he ought to be able to describe the chemical and magnetical effects of such a current. He ought to be able clearly to contrast those actions as manifested by frictional electricity with the same actions as manifested by voltaic electricity.

He ought to be able to describe the experimental arrangements necessary to the production of primary, secondary, tertiary, and currents of higher order by the discharge of the electric battery.

He must understand the law of inverse squares as applied to electricity, and clearly comprehend its limitations.

The diurnal variation of atmospheric electricity ought to be known to the pupil.

The application of the unit jar in the measurement of electric charges ought to be known to the pupil.

The terms quantity and intensity (or as it is called by some *density*) as applied to electricity ought to be clearly understood. The relation of the heating power of an electric discharge to its quantity and intensity ought also to be known to the pupil.

Voltaic Electricity.

The more advanced pupil must be intimately acquainted with the subjects mentioned in the first course.

To the electro-magnetical knowledge there demanded he is to add the knowledge of determining the strength of a current by the deflection of a magnetic needle.

He ought also to be able to determine the relative strength of two currents by their chemical action.

He ought to know how the magnetism of a bar of iron augments in intensity as the currents which surround it augments in strength.

He ought to know how the *attraction* of iron by an electro-magnet augments as the exciting current is augmented. In this case he ought to see and be able to describe the difference between a piece of soft iron and a piece of exceedingly hard magnetized steel.

He ought to be acquainted with induced currents, their various modes of generation, and their laws of action.

He ought to be able to explain the ordinary madical magneto-electric coil. He ought also to be able to describe Ruhmkorff's coil, and some of the effects obtainable by it.

He ought to be able to sketch a current reverser.

He ought to understand the principles of the astatic needle.

He ought to be able to describe the phenomena of the extra-current.

He ought to be made acquainted with the mutual action of currents upon each other, with the attractions and repulsions which are dependent upon direction.

He ought to know how a coil of copper wire may be suspended so that when a current flows through the wire it shall, like a magnetic needle, obey the directive action of the earth.

He ought to be acquainted with the principles of electro-plating, adding to a knowledge of the decomposition of water a knowledge of other decompositions, by which conducting surfaces may be coated with copper, silver, or gold.

He ought also to be made acquainted with the chemical actions that occur within a voltaic cell when the current circulates.

The arrangement of cells into batteries ought to be described. The pupil ought to be made acquainted with the *pile* of Volta and the *crown of cups*. He ought also to have explained to him the battery of Grove.

The reason for employing two fluids in the cells of this battery ought to be explained.

The dependence of the heat generated on the resistance overcome by the current ought to be made known. He ought to be taught to form as definite a conception as possible of resistance in relation to electro-motive force, and to understand the formula which expresses the relation of heat, resistance, and current strength.

He ought to understand the theory of molecular currents, and to be able to apply this theory in explanation of the phenomena of magnetism.

Examination for Honours.

Magnetism.

A candidate who enters the honours examination must be intimately acquainted with the foregoing two courses in magnetism. In addition to this he must be able to show that he has a competent practical knowledge of the apparatus employed. He must show ability in devising and executing experiments, and ought to be able in the presence of the examiner to perform experiments illustrative of any or all of the subjects introduced in the foregoing two courses.

Frictional Electricity.

The candidate ought also to know the facts and principles of dia-magnetism. He ought also to be able to describe and explain the deportment of crystalline bodies between the poles of a magnet.

In frictional electricity, besides an intimate acquaintance with both of the foregoing courses, the candidate must possess a competent practical knowledge of the apparatus employed. He must be able to devise and execute experiments in the examiner's presence. He must be intimately acquainted with the experiments with a rotating mirror by which Wheatstone determined the velocity of electricity and the duration of the electric spark.

Voltaic Electricity.

Besides being intimately acquainted with the two foregoing courses, the candidate must have a practical acquaintance with the apparatus employed in voltaic electricity.

He must be intimately acquainted with the laws of Ohm which express the relation of electro-motive force, internal and external resistance, and current strength.

He must be able to apply the principles of the dynamical theory of heat to the heat phenomena of the voltaic current. He must be clearly informed as to the manner in which the heat is distributed within and without the battery.

As a text book, in addition to the works on Physics and Natural Philosophy recommended in the Syllabus of Subject VIII., the following work on Electricity may be used:—

Electricity, by R. M. Ferguson, 12mo., 3*s*. 6*d*.
(Edinburgh, Chambers, 1866.)

SUBJECT X.—INORGANIC CHEMISTRY.

First Stage or Elementary Course.

Pupils presenting themselves for examination will be expected to possess a knowledge of the following subjects:—

Definition of chemistry. Simple and compound matter. Different modes of chemical action. Combining weights. Volume weights. Principles of chemical nomenclature. Symbolic notation. Graphic notation. Chemical formulæ. Chemical equations. Atomicity of elements. Simple and compound radicals. Definition of a compound radical. Classification of elements into metals and non-metals, into chlorous and basylous elements. Classification according to atomicity.

French and English systems of weights and measures. Conversion of English into French weights and measures. The crith and its uses.

Hydrogen.—Its preparation and properties.

Chlorine.—Preparation of chlorine from hydrochloric acid. Analysis and synthesis of hydrochloric acid. Properties and reactions of hydrochloric acid.

Oxygen.—Its preparation and properties. Allotropic oxygen or ozone. Formation and reactions of water. Preparation and properties of hydroxyl. Oxides and oxacids of chlorine.

Boron.—How it occurs in nature. Its allotropic modifications. Boric anhydride. Boric acids.

Carbon.—Its preparation and allotropic forms. Preparation and properties of carbonic oxide and carbonic anhydride.

Nitrogen.—Its preparation and properties. Oxides and oxacids of nitrogen. Compound of nitrogen with hydrogen. Ammonia. Ammonic salts.

Sulphur.—Its properties and allotropic modifications. Compounds of sulphur with basylous elements. Compounds of sulphur with oxygen and hydroxyl.

Second Stage or Advanced Course.

In addition to the above subjects, pupils presenting themselves for the advanced examination will be assumed to have received instruction in the following:—

Theory of atoms and molecules. Empirical, rational, and constitutional formulæ. Absolute, latent, and active atomicity. Atomic and molecular combination.

Expansion of gases by heat. Reduction of gaseous volumes to standard pressure and temperature.

Manufacture of hydrochloric, nitric and sulphuric acids. Composition and manufacture of bleaching powder. Theory of bleaching. Suitability of water for domestic purposes. Causes of permanent and temporary hardness in water.

Bromine.—Hydrobromic and bromic acid.

Iodine.—Hydriodic, iodic, and periodic acid.

Fluorine.—Hydrofluoric acid.

Silicon.—Silica. Silicic acid. Silicic hydride. Names and formulæ of some of the more important silicious minerals.

Phosphorus.—Phosphoretted hydrogen. Acids and anhydrides of phosphorus.

Arsenic.—Arsenious and arsenic acids. Arseniuretted hydrogen. Detection of arsenic.

Antimony and Bismuth.—Preparation and properties of their chief compounds.

The monad metals, especially potassium, sodium, and silver. Manufacture of soda-ash.

The dyad metals. Barium, strontium, calcium, magnesium, zinc, cadmium, mercury, and copper.

The chief properties of the following metals:—Gold, aluminium, platinum, lead, chromium, manganese, iron, cobalt, and nickel.

Composition, preparation and properties of the more important compounds of these metals.

Outline of qualitative analysis. Reactions of the principal mineral acids and bases. Course pursued in the application of these reactions to the analysis of a mixture of several acids and bases.

Examination for Honours.

In addition to the above, candidates are expected to possess a knowledge of the following subjects:—

Theory of normal, acid, and basic salts. Constitutional formulæ of the various acids of phosphorus. Monatomic and polyatomic molecules.

The phenomena of combustion.—Thermal units. Absolute thermal effect, or total amount of heat evolved by various kinds of fuel and other combustibles. Pyrometric thermal effect, or intensity of heat evolved by combustibles. Translation of absolute thermal effect into its mechanical equivalent. Theory of flame. Source of light in luminous flames. Spectrum analysis, its principles and applications. Relations of specific heat to atomic weight.

The law of the diffusion of gases. The laws of electrolysis. The processes used in the quantitative analysis of the more commonly occurring minerals.

For preparation for examination in the above syllabus, the following works are recommended as text books:—

Lecture Notes for Chemical Students, by E. Frankland, 8vo., 12*s.* (London, Van Voorst, 1866.)

First Principles of Modern Chemistry, by U. J. Kay-Shuttleworth, 8vo., 4*s.* 6*d.* (London, Churchill, 1868.)

Introduction to Modern Chemistry, by A. W. Hofmann, 8vo., 4*s.* 6*d.* (London, Walton, 1865.)

First Step in Chemistry, by R. Galloway, 12mo., 6*s.* 6*d.* (London, Churchill, 4th ed., 1868.)

Lessons in Elementary Chemistry, by H. E. Roscoe, 18mo., 4*s.* 6*d.* (London, Macmillan, new ed., 1867.)

For the advanced course the following may be used in addition to the above:—

Chemistry, Inorganic and Organic, by C. L. Bloxam, 8vo., 16*s.* (London, Churchill, 1867.)

Manual of Elementary Chemistry, by G. Fownes, 12mo., 12*s.* 6*d.* (London, Churchill, 9th ed., 1863.)

Elements of Inorganic Chemistry, by W. A. Miller, 8vo., 21*s.* (London, Longman, 3rd ed., 1864.)

Chemistry for Students, by A. W. Williamson, 12mo., 7*s.* 6*d.* (London, Macmillan, 1865.)

Qualitative Analysis, by R. Galloway, 8vo., 6*s.* 6*d.* (London, Churchill, 5th ed., 1869.)

Besides these works the following are recommended for reading for honours:—

Second Step in Chemistry, by R. Galloway, 12mo., 10*s.* (London, Churchill, 1863.)

Chemical Physics, by W. A. Miller, 8vo., 15*s.* (London, Longman, 4th ed., 1867.)

Dictionary of Chemistry, and the Allied Branches, by H. Watts, in four Vols., 8vo., 1st Vol., 31*s.* 6*d.*, 2nd Vol., 26*s.*, 3rd Vol., 31*s.* 6*d.*, 4th Vol., 24*s.* (London, Longman, 1863–66.)

Elementary Treatise on Heat, by Balfour Stewart, 12mo., 7*s.* 6*d.* (London, Macmillan, 1866.)

Heat considered as a Mode of Motion, by J. Tyndall, 8vo., 12*s.* 6*d.* (London, Longman, 2nd ed., 1866.)

SUBJECT XI.—ORGANIC CHEMISTRY.

First Stage or Elementary Course.

Pupils presenting themselves for examination will be expected to possess a knowledge of the following subjects:—

Definition of organic bodies; their ultimate analysis. Calculation of empirical formulæ. Compound organic radicals. Notation of organic compounds. Graphic and symbolic formulæ.

Organic Radicals.—Basylous or positive radicals. Preparation and properties of the monad radicals of the methyl series. Monad radicals of the vinyl and phenyl series.

Dyad basylous radicals of the ethylene series. Preparation and properties of ethylene.

Chlorous or negative radicals. Cyanogen. Oxatyl. Oxalic acid, its preparation and properties.

Hydrides of the Organic Radicals.—Methylic hydride or marsh gas. Paraffin. Benzol. Cyanic hydride or hydrocyanic acid. Oxatylic hydride or formic acid.

The Alcohols.—Definition of an alcohol. Methylic alcohol. Ethylic or common alcohol. Phenylic alcohol or carbolic acid.

The Ethers.—Definition. Preparation and properties of ethylic ether.

The Haloid Ethers.—Their constitution. Preparation and properties of ethylic chloride and iodide.

The Aldehydes.—Their nature and properties. Acetic aldehyde. Benzoic aldehyde or oil of bitter almonds.

The Acids.—Definition of an organic acid. Acetic acid. Lactic acid, Benzoic acid.

Ethereal Salts.—Definition and constitution of the ethereal salts of the monobasic acids. Preparation and properties of acetic ether and butyric ether.

Second Stage or Advanced Course.

In addition to the above subjects, students presenting themselves for this examination will be assumed to be acquainted with the following :—

Determination of the rational formulæ of organic acids and bases. Graphic and symbolic types of organic compounds. Reduction and development of the formulæ of organic bodies. Classification of organic compounds.

Organic Radicals.—Dyad basylous radicals of the acetylene series. Single and double cyanides. Manufacture of prussian blue and of oxalic acid.

Hydrides of the Organic Radicals.—Ethylic and amylic hydrides. Hydrides of the radicals of the phenyl series. Manufacture of coal-gas.

The Alcohols.—Classification, preparation and properties of alcohols 1. Monacid alcohols; methyl series, vinyl series, allyl series, phenyl series. 2. Diacid alcohols or glycols; ethylic glycol and its derivatives. 3. Triacid alcohols; glycerin, its preparation and properties.

The Ethers.—1. Ethers of the monacid alcohols;—methylic ether, allylic ether, phenylic ether. 2. Ethers of the diacid alcohols;—ethylenic oxide. 3. Ethers of the triacid alcohols;—glycylic ether.

The Haloid Ethers.—Haloid ethers of the monad, dyad, and triad positive radicals. Methylic chloride. Manufacture of chloroform. Ethylenic bromide.

The Aldehydes.—Formation and re-actions of the aldehydes of the methyl, vinyl, and phenyl series of alcohols.

The Acids.—Law of basicity of organic acids.

Monobasic acids :—Acetic or fatty series. Acrylic or oleic series. Lactic series. Pyruvic series. Glyoxylic series. Benzoic or aromatic series.

Dibasic acids :—Succinic series. Fumaric or acryloid series. Malic or lactoid series. Tartaric or glyoxyloid series.

The Anhydrides.—Definition and constitution of the anhydrides. Formation and re-actions of the anhydrides of monohydric monobasic acids, dihydric monobasic acids, and of dihydric dibasic acids.

The Ketones.—Derivation and constitution of the ketones. Preparation and properties of acetone.

Ethereal Salts.—Ethereal salts of dibasic and tribasic acids, and of monacid, diacid, and triacid alcohols.

Organic Compounds containing Nitrogen, Phosphorus, Arsenic and Antimony.—The more important natural and artificial alkaloids. Extraction of quinine from cinchona bark.

Organometallic Bodies.—Definition. Their behaviour and formation. Preparation and properties of zincic ethide, mercuric ethide and stannic ethide.

Examination for Honours.

In addition to the above, the candidate should be well acquainted with the following subjects :—

Determination of the specific gravity of gases and vapours. The methods employed in the analysis of gaseous organic bodies. Synthesis of organic compounds. Determination of the constitutional formulæ of organic bodies. Isomerism, metamerism and polymerism in organic bodies.

Organic Radicals.—Normal, secondary, and tertiary monad radicals. Isomerism of ethylene and ethylidene compounds. Relations between methyl, oxatyl and cyanogen.

Hydrides of the Organic Radicals.—Relations of the basylous monad radicals to their hydrides.

The Alcohols.—Relations of the normal monacid alcohols to the monad C_nH_{2n+1} radicals, the dyad C_nH_{2n} radicals, and to the hydrides of the $C_n H_{2n+1}$ radicals.

Secondary monacid alcohols. Isopropylic, pseudamylic and pseudohexylic alcohols.

Tertiary monacid alcohols. Pseudobutylic alcohol.

Normal and secondary alcohols of the phenyl series.

Relations of glycerin to isopropylic and allylic alcohol; also to glyceric, tartronic, and acrylic acid.

Other polyacid alcohols:—Erythrite, mannite, glucose.

The Acids.—Difference between hydricity and basicity of acids.

Normal, secondary, and tertiary fatty acids. Relations of the fatty acids to the C_nH_{2n+1} series of radicals, and to the $C_nH_{2n+1}Ho$ series of alcohols. Relations of the fatty acids to each other; ascent of the series.

Normal, secondary, and olefine acids of the acrylic or oleic series. Relations of the acrylic to the acetic series of acids.

Definition and classification of the acids belonging to the lactic series Relations of the lactic to the fatty and acrylic series of acids. Isomerism in the lactic series.

Relations of the pyruvic series of acids to the oxalic and lactic series.

Relations of the glyoxylic series of acids to the glycerin series of alcohols.

Constitution and classification of the dibasic acids. Relations of the succinic series of acids to the lactic and acetic series, and to the glycols.

Isomerism in the fumaric series of dibasic acids.

Tartaric or glyoxyloid series of dibasic acids. Varieties of tartaric acid.

Constitution and classification of the tribasic acids.

The Ketones.—Isomerism in the ketone family.

Organic Compounds containing Nitrogen, Phosphorus, Arsenic, and Antimony.—The amines, phosphines, arsines, and stibines. Primary, secondary, and tertiary organic bases. Monamines, diamines, triamines, and tetramines.

Organometallic Bodies.—Their constitution and its bearing upon the doctrines of atomicity.

In addition to such of the works as treat on Organic Chemistry recommended in the Syllabus of Subject X., the student's attention is drawn to the following:—

Elements of Organic Chemistry, by W. A. Miller, 8vo., 24*s*.
(London, Longman, 3rd ed., 1866.)

SUBJECT XII.—GEOLOGY.

First Stage or Elementary Course.

A.—Preliminary Subjects.

a. Basis of Geology.—Definition of the objects of geology. Waste of land now going on by mechanical causes,—rain, running water, frost, snow, glaciers, and by the sea. Origin of rounded pebbles, grains of sand, and mud. Sediments carried in mechanical suspension in rivers. Deposition of strata now forming in the sea and in lakes from sediments

formed mechanically. Other strata formed in part or entirely of organic remains, and how they are preserved. Proof that stratified rocks generally were formed by deposition from water, as above, and that strata have been successively deposited and are of ages less or more apart. Definition of the term igneous as applied to rocks.

b. Common Geological terms.—Definition of "crust of the earth," clay, sand, gravel, shale, sandstone, conglomerate, breccia, limestone, lava, volcanic ashes, stratum or bed, *a formation,* group of formations. Recent, Cainozoic (tertiary), Mesozoic (secondary), and Palæozoic formations. Horizontal, inclined, vertical strata. Anticlinal and synclinal curves. Contorted strata, dip, strike, outcrop, a basin. Conformable and unconformable stratification, joint, slaty cleavage, fault, lode, vein. Names of some of the metamorphic rocks.

c. Composition of principal rocks and their common minerals.—Minerals that form granites and granitic rocks; Syenites, Diorites (greenstones), Basalts, Dolerite, gneissic rocks, limestones. Coal, what originally formed from. Colouring matter of rocks.

d. Disintegration and Solutions.—Disintegration, and solutions of minerals composing rocks by means of acids; mineral springs, and substances in chemical solution in rivers, lakes, and the sea. How produced.

e. Snow and Ice.—How glaciers are formed from snow. Movement of glaciers and transport of matter on their surfaces. Moraines. Erosion of rocks, over which glaciers flow. Icebergs, whence derived. Transport of matter from cold to warmer latitudes by icebergs.

f. Rivers.—Cutting out of terraces *and valleys* by rivers. Transport of material seaward, and gradual growth of Deltas.

g. Marine Denudation, Transport and Consolidation of Material and Fossilization.—Waste of sea coasts by breakers and by help of landslips. Rounding of pebbles and grains of sand on shores and in streams. The effect of long continued marine denudation on the land; formation of bays and head-lands, &c. Distribution of sediments derived from land over sea bottoms, forming modern marine strata. Consolidation of strata by pressure, chemical changes and heat. Preservation of shells, &c., in seas, lakes, and delta deposits, in alluvium, and in and under peat, blown sand, and volcanic ashes.

h. Central Heat, Volcanos, Earthquakes, and other Movements of the Earth's Crust.—The connexion of the corals reefs of the Pacific Ocean with the gradual sinking of the sea bottom. Fringing reefs, barrier reefs, atolls. Volcanos and their connexion with some areas of upheaval of land above the sea. Raised beaches and sea bottoms. The structure of volcanos. The wave-like motion of earthquakes. General structure of mountain chains. The existence of so-called central heat in the earth. Change of common strata, such as shale and slate, sandstone, limestone, &c., into mica-schist, gneiss, quartz rock, crystalline limestone, &c. (metamorphism).

B.—Classification of Animal and Vegetable Life.

i. A rudimentary acquaintance with the meaning of the names of those CLASSES of animals and plants that are or may be found fossil, such as Mammalia, Aves (birds), Reptilia, Pisces (fish), Insecta, Myriapoda (centipeds, &c.), Arachnida (spiders, &c.), Crustacea (crabs, &c.), Annelida (worms, &c.), Echinodermata (sea-urchins, starfish, &c.), Cephalopoda (cuttle-fishes, &c.), Pteropoda, Pulmonata (land snails, &c.), Gasteropoda (periwinkles, limpets, &c.), Conchifera (oysters, cockles, &c.), Brachiopoda (terebratula, &c.), corals, sponges. The Vegetable Kingdom: the names of the classes and orders of plants.

Succession of Strata, Igneous Rocks, &c.

C.—Palæozoic Series.

k. Oldest known stata or the Laurentian rocks. Their metamorphic character. Oldest known fossil. Huronian rocks of Canada.

l. Cambrian and Silurian strata.—Cambrian rocks, and their traces of fossils. Lingula flags and Tremadoc slates. Llandeilo and Bala beds, and the lavas and volcanic ashes associated with them. Llandovery or Pentamerus beds. Upper Silurian series. Leading kinds of fossils common in these formations, such as the genera of Graptolites, Corals, Brachiopoda, Conchifera, Cephalopoda (chambered shells), Echinodermata, Crustacea (especially the Trilobites), and first appearance of fish remains and land plants.

m. Old Red Sandstone and Devonian strata.—The areas in Britain that formed land before the deposition of the Old Red Sandstone. Unconformities of Old Red Sandstone on older rocks. Division into lower and upper Old Red Sandstone and unconformity. The nature of the rocks. The fish found in the lower, and the fish, fresh-water shells and plants in the upper Old Red Sandstone. *Devonian strata.*—Commonly divided into lower, middle, and upper. Their marine fauna, corals, shells bivalve and univalve, Goniatites and other cephalopoda, Trilobites, &c. Difference between the Silurian and Devonian genera and species.

n. Carboniferous strata.—The ordinary succession of these strata in Wales and the South of England (See also parts of 16 in Advanced Stage). The kinds of corals, shells, and fish found in the Carboniferous Limestone, and other beds. The kind of sections found in the *Coal-measures*. The Underclay generally below beds of coal. How coal was formed from fossilized plants. How there came to be many beds of coal in one coal-field with beds of shale, ironstone, and sandstone between.

o. Permian formations.—Their succession in England and Germany, and the proofs of their unconformity on the Carboniferous strata. The structure of the Rothliegende or Brecciated Conglomerates, the Marl-slate or Kupferschiefer, the Magnesian limestone (Zechstein). Their fossils.

D.—Mesozoic or Secondary Series.

Lower Mesozoic.

p. New Red Sandstone or Trias.—British divisions: 1st. New Red Sandstone (Bunter); 2nd. New Red Marle (Keuper). Continental divisions. New Red Sandstone, Muschelkalk, New Red Marle. Unconformity on Permian and older rocks. Great changes of life in passing from Palæozoic to Mesozoic times. Change in the relative numbers of Brachiopoda and Conchifera when compared with Palæozoic rocks, and continuation of this down to present day. New Cephalopoda, encrinites, fish, and reptiles. First known mammal. Plants of the Keuper sandstone, crustacea, reptiles, &c. Origin of rock-salt by evaporation. Gypsum of red marle. Parts of what is now the British Islands that formed land before the deposition of the Trias.

q. Rhætic or Penarth beds.—(See 19, p. 102.)

r. Lias formations and Oolites.—(Jurassic of the continent). Division into Lower, Middle, and Upper Lias, and Lower, Middle, and Upper Oolites. The names of the formations included in each of these. Characters of the rocks. Great development of life of these periods. Leading marine fossils of the Lias and land plants and insects. Common

genera of Brachiopoda and Conchifera, Gasteropoda, Cephalopoda, Echinodermata, Fish, and Reptiles. Leading fossils of the Oolites as above, and also Mammalia. Proofs of land in the neighbourhood of the British Liassic, and Oolitic seas.

s. Purbeck and Wealden strata.—Their estuarine character, and proofs of this from the fossils. Generic names of leading fossils. Proofs of the existence of a neighbouring large continent.

Upper Mesozoic.

t. Cretaceous series.—British divisions, Lower and Upper and their subdivisions. The nature of the strata and general grouping of fossils (as in *r* above). Differences when compared with Oolitic genera and species. Uppermost Cretaceous beds absent in Britain, viz. the Maestricht and Faxoe beds and the beds of Aix-la-Chapelle. Account of these.

E.—Cainozoic or Tertiary Series.

u. Eocene or Lower Tertiary.—Meaning of the terms Eocene, Miocene, and Pliocene. Areas occupied by the English and French Eocene strata, and divisions of the English Eocene strata. Their fossils, freshwater, estuarine, and marine. Proofs of neighbouring land in freshwater shells, plants, and terrestrial mammalia.

v. Miocene or Middle Tertiary, of Bovey-Tracey, Mull, &c. French marine strata and freshwater and volcanic formations. The kinds of fossils they contain. The Swiss, Italian, and other continental beds. The floras of the period, insects, mammalia, reptiles, shells, &c. The Arctic Miocene beds, and flora. Indian Miocene strata and their fossils.

w. Post-Pliocene strata, Crag, &c.—Divisions of the British Crag, characters, and fossils, marine and terrestrial. Economic products. Crag of Belgium. Proportions of recent species in the different members of the Crag. Sub-Appenine strata and those of Sicily.

x. Glacial period and other strata later than the Crag.—The Forest beds beneath the boulder clay, and the union of Britain with the continent, and its Flora, terrestrial Fauna, and shells. (See also 26, p. 104.) The glaciers of the glacial period, before, during, and after the deposition of the marine boulder clays. The origin and nature of the boulder clay. Other proofs of a cold climate, and the marine and terrestrial Fauna of the period.

Second Stage or Advanced Course.

A.—Preliminary Subjects or Principles.

1. All contained in *a* of the elementary stage.
2. All contained in *b*.
3. All contained in *c*, and the chemical constituents of silica, various felspars, micas, augite, diallage, hornblende, garnet, obsidian, pitchstone, pumice. Limestone, Magnesian limestones or Dolomite. Coals, such as common house and furnace coals, cannel coals, and anthracites. Iron ores. The colouring matter of rocks. The general relative proportions in the known crust of the earth of mineral substances, such as silica, alumina, lime, magnesia, iron, &c., &c.
4. *Chemical disintegration.*—Chemical disintegration of rocks on a large scale; formation of kaolin, fireclays and other clays and shales. Origin of mineral springs, and substances in solution in rivers, seas, and other waters. Skeletons of shell fish and other marine and fresh water animals, whence derived, and how strata are formed of these.

5. *Effects of snow and ice.* — What is a glacier, and how formed. Change of snow into solid ice. Stratification and veined structure of ice. Inclinations of beds and surfaces of glaciers. Why glaciers flow. Rates of progress. Crevasses. Moraines, lateral, medial, terminal, and how they are formed. Erosion of rocks under glaciers and its results. Flow of water from lower ends of glaciers. Destruction of terminal moraines, and circumstances that induce their occasional preservation. Oscillation of size of glaciers. Deepening of valleys. Signs left by glaciers that have disappeared. Icebergs of Arctic and Antarctic regions and of South America; how formed. Ocean currents. Transport of matter by icebergs, and its distribution over existing sea bottoms. Transport of detritus by coast ice and river ice.

6. *Landslips.*—Landslips in mountainous and hilly regions, and landslips on sea coasts. Their effect in bringing matter within the influence of running water and of the sea.

7. *Rivers.* — Erosive and transporting power of brooks and rivers. Their influence in forming gorges and valleys. Origin of waterfalls. Amount of matter carried seaward by great rivers such as the Nile, the Ganges, the Mississippi, &c. The mode of formation and gradual growth of deltas and their possible age. Filling up of lakes by sediments. General effects on the form of the ground and lowering of level of continental and smaller areas by combined effects of chemical disintegration, rain, rivers, frost, snow, and glacier ice.

8. *Marine denudation.*—Waste of sea coasts by breakers and landslips. Formation of pebbles and sand on sea coasts. Amount and nature of waste of boulder clays of eastern coasts of England, &c.; of Tertiary strata, and of Cretaceous and Oolitic strata on east and south coasts. Waste of harder rocks of west of England, Wales, and Scotland. Power of breakers in moving sand and shingle, and large blocks of stone. Effect of prevalent winds on waste and transport of material along shores. Silting up of estuaries. Effect of groins and other artificial obstructions on coasts. Warping of alluvial tidal flats. Forms of sea cliffs and origin of many bays and headlands. Origin of great plains of marine denudation by combined action of breakers, landslips, and general lowering by waste of the interior of countries. Subsequent upheaval of such plains and renewed scooping out of valleys. Origin of certain tablelands and their valleys.

9. *Distribution of Material in Sea, &c. forming Modern Strata.*—Transport of matter by great marine currents, passing mouths of rivers and along coasts. Transporting powers of tidal currents. Sifting action of the sea in arranging sediments along its bottom. Icebergs (see 5). Modern formation by above causes of beds of clay, sand, gravel, and boulder beds, and mixtures of these. Volcanic ashes falling in sea and lakes. General formation of lacustrine strata. Formation of beds of limestone by organic bodies in seas, lakes, and lagoons. Coral reefs (see 10). Salts carried in solution in rivers into lakes, evaporation of surplus water, concentration and precipitation. Origin of rock salt, &c.

10. *Fossilization and Consolidation of Strata.*—Shells and other marine organic remains buried in sediments. Also terrestrial plants. Worm burrows. Terrestrial animals. Organic remains in lakes and river deltas, in alluvial beds and brickearths; in and under peat, under blown sand, and in volcanic ashes and under lavas. Formation of sediments by foraminiferæ, &c. in deep seas. Consolidation of strata by pressure, infiltrations, and precipitations, chemical decomposition and recomposition and heat.

11. *Central Heat, Volcanos, Earthquakes, and other Movements of the Earth's Crust.*—Theory of Coral Reefs. Fringing reefs, Barrier reefs, Atolls, and proofs of gradual subsidence of the sea bottom. Connexion

of coral reefs with the volcanic islands of the Pacific Ocean and areas of partial upheaval. Upheaval of the west coast of South America. Oscillations of level on the coast of the Baltic, Greenland, &c. Raised beaches and sea bottoms.

Theories of central heat how inferred. Radiation of heat from the earth, consolidation and theory of the formation and shrinkage of its crust. External phenomena of volcanos, and theories of volcanic action. Earthquakes. Mallet's theory, and oscillations of level accompanying earthquakes.

Metamorphism of rocks. Theory of slaty cleavage, passage of shales clayslate, sandstone, limestone, and their intermediate gradations into mica-schist, chlorite-schist, various kinds of gneissic rocks, quartz-rock, crystalline limestones, &c. Special development of distinct minerals in rocky masses. Relation of the above to gradual subsidence of rock masses and accumulation of strata above them. Origin of mountain chains. Disturbance and contortion of strata in successive stages, and probable causes of these phenomena.

B.—Classification of Animal and Vegetable Life.

12. All contained in *i* of the Elementary stage, p. 96, together with a general knowledge of the orders of Mammalia, Birds, Reptiles, Amphibia, Fish, Insects, &c., Crustacea, Echinodermata, Cephalopoda, Pteropoda, Pulmonata, Gasteropoda, Conchifera, Brachiopoda, Polyzoa, Corals, &c., and the classes and orders of the vegetable kingdom.

Succession of Strata, Igneous Rocks, &c.

C.—Palæozoic Series.

13. *Laurentian rocks* of Scotland, and Lower and Upper Laurentian rocks of Canada, &c. Huronian rocks of Canada. Their metamorphic character and peculiarities of structure. Eozoon Canadense, its nature, structure, and mode of growth. Ages of their metamorphism, and the inferences to be drawn from this.

14. *Cambrian and Silurian strata.* *Cambrian rocks* and their passage nto the Lingula flag series. Fossils of the Cambrian rocks; their slaty cleavage and slate quarries.

Lower Silurian.—Lingula flags, their lithological character and fossils. *Tremadoc slates,* their lithological character and fossils. Unconformity of the Llandeilo and Bala beds on these, and break in the succession of life. *Llandeilo and Bala beds,* their lithological character and fossils. The igneous rocks, lavas, ashes, &c. associated with these.

Upper Silurian.—Llandovery or *Pentamerus beds,* their fossils and unconformity on the Lower Silurian strata, and partial change of species. Remainder of the *Upper Silurian strata* of the Wenlock and Ludlow series, their characters and fossils. First appearance of fish. Remains of plants. Reasonings on the connexion of unconformable stratification with partial or total breaks in the succession of species and genera in time. (This may be applied to all the cases of unconformity subsequently noticed.)

15. *Old Red Sandstone and Devonian strata.*—Passage of Upper Silurian into Lower Old Red Sandstone in Wales and on its borders. Disappearance of the life of the Silurian period. The land that existed in Scandinavia and Britain before the deposition of the Old Red Sandstone, and round and on which the Old Red beds were deposited. Fish of the lower Old Red Sandstone; their distinctive characters.

Upper Old Red Sandstone.—Lithological characters, fish, shells, and plants. Unconformity of the upper on the lower Old Red Sandstone, and approximate or actual passage of the former into the Lower Carboniferous strata. Condition of the waters in which the Old Red Sandstone formations were probably deposited. If partly glacial, and the signs of this?

Devonian strata.—The division of these strata commonly made into Lower, Middle, and Upper Devonian. The marked difference of conditions of deposit shown in the general nature of their fossils, viz., the fish of the Old Red Sandstone, and the Corals, marine bivalve and univalve shells, Cephalopoda and Trilobites of the Devonian strata. The stratigraphical relation of the Devonian strata to the Silurian rocks of Devon and Cornwall, of Germany, and North America. The relation of the so-called Upper Devonian beds to the Carboniferous strata. The appearance of new genera and species in the Devonian rocks. The plants of the North American beds.

16. *Carboniferous strata.*—Succession of Carboniferous strata in Wales, and its borders, and the south of England, viz., Lower limestone shale, Carboniferous limestone, Upper limestone shale, Millstone grit, and Coal-measures. The lithological characters of these and their fossils, marine, freshwater, and terrestrial. The manner in which the beds below the Coal-measures were accumulated. The manner of the formation of the Coal-measures, the peculiar strata beneath each (or most) beds of coal, the nature of the plants that formed the coal, their mode of growth, and the cause of the succession of beds of coal in thick series of strata. The gradual passage of the Carboniferous strata into a set of beds differently arranged in their stratification, especially in their lower members, proceeding northwards through Lancashire and Yorkshire into Northumberland, and Scotland. The physical causes that produced this difference. Also the absence of certain members of the series in some of the English, and in part of the Scotch coal fields and the physical phenomena that caused this absence. The Carboniferous series as developed in Ireland. The Carboniferous rocks of the continents of Europe and North America. Their resemblances to those of the British islands; climate, its average uniformity in space and time during this epoch. The surface areas occupied by the European Carboniferous strata now. The areas where they may be concealed under newer formations. The areas where originally formed, viz., which they spread over before reduced to their present limits by denudation. The disturbances of the Carboniferous rocks, and the reasons why coal fields (like parts of many other formations) so often lie in basins. Various kinds of coal, such as the varieties of coal commonly called bituminous, cannel coal, and anthracite. The chemical changes that vegetation underwent in its passage into coal, first on the surface, and afterwards under pressure. The passage of "bituminous" into anthracite coal and the probable reason, and the connexion of this subject with highly disturbed areas. Specialities. Development of crustacea of the Carboniferous rocks as distinguished from those of the Devonian and Silurian periods. Prevalence of certain genera of brachiopoda and conchifera, and relative proportions of these in the Carboniferous rocks when compared with older formations. Fish and reptiles of the Carboniferous rocks. Footprints, rain drops, land shells, and insects, and what they indicate. Ironstones. Mineral veins in Carboniferous limestone series.

17. *Permian formations.*—Succession of these in Britain, Germany, and Russia. 1st. The Rothliegende, its structure, and the evidences of the glacial agencies by which parts of it were deposited. 2nd. The

Kuperschiefer of Germany and Marle-slate of England, with mineral contents, fish, &c. 3rd. The Magnesian limestone (Zechstein), its mineral character and composition; its fossils; evidence of their palæozoic character, partial community of species, and numbers and size when compared with the genera and species of the Carboniferous limestone. Cause of this. Unconformity on the Carboniferous and older rocks; submersion of old lands during its deposition; bearing of this on conglomeratic and brecciated structure of the Rothliegende and the general development of the life of the period, including plants and reptiles.

D.—Mesozoic or Secondary Series.

LOWER MESOZOIC.

18. *Divisions of Trias, or New Red Sandstone series* (see *p*, p. 97).—Unconformity and great break in succession of life in passing from Permian to New Red Sandstone. Great development of conchifera and decrease of genera of brachiopoda. The relation of this to lapse of time, as shown by unconformity, and continued prevalence in later times of many of these early Mesozoic types. The generally unfossiliferous character of the New Red Sandstone beds (Bunter), and their minor divisions in England. The absence in England of the Muschelkalk, and its presence on the Continent. Its fossils (see *p*, p. 97). The minor divisions of the New Red Marle (Keuper). Its fossil plants and reptile bones and footprints. Microlestes. Rain drops. The rock salt of this formation, and how it was deposited. Theory of inland salt lakes or seas of the the present day, and the bearing of this and of the above-named marks of rain drops and footprints on the point. New Red Sandstone of the United States, and numerous footprints of reptiles and impressions of bird-like feet. Gypsum. Those parts of the British islands that formed land before and during the New Red Sandstone period.

19. *Rhætic or Penarth Beds.*—Intermediate between New Red Marle and Lower Lias. Gradual passage of nearly unfossiliferous red marles into these more fossiliferous strata. Character and names of some of the common fossils, each as *Avicula contorta, Cardium Rhæticum,* &c. Their affinities with Liassic forms and conformable passage into that formation in Britain.

20. *Lias formations and Oolites.* (Jurassic of the Continent).—Names of the several formations of the Lias and Oolites between the Lower Lias and the Portland Oolite in serial order, and their grouping into Lower, Middle, and Upper Lias and Oolite. Lithological characters of the Liassic formations. Fossils of the different formations. Plants and insects. Corals, brachiopoda, conchifera, gasteropoda, cephalopoda, echinodermata, crustacea, fish, and reptiles. The distinctive characters of some of these, their relative numbers compared with the same classes in the Palæozoic rocks. Nature of the connexion of the Lias with the Inferior Oolite. Lithological characters of the Oolitic formations and their uses. Marine fossils of the different formations of the above-named classes; also mammalia. Evidences of the existence of older land in the neighbourhood of the Liassic and Oolitic seas, and of the climate of the period drawn from plants and animals. Names of the most characteristic genera of Lias and Oolites, especially with reference to their prevalence, such as the names of the prevalent genera of brachiopoda, conchifera, gasteropoda, and cephalopoda, echinodermata, crustacea, fish, and reptiles. Jurassic strata of the Continents of Europe and Asia. The Jura and the Alps, and the fossils of Solenhofen. Disturbance and metamorphism of Jurassic strata. Names of some of the species charac-

teristic of some of the formations, and extent of the community of species. Contrast the life of these epochs with similar developments in Palæozoic epochs.

21. *Purbeck and Wealden strata.*—Their general fresh-water nature and marine interstratifications. Extent of these formations in England and on the Continent. Their characters and thickness. Fossils of the Purbeck strata. Plants, land-insects, mammalia, fish, reptiles, univalve and bivalve shells, and crustacea. Fossils of the Wealden formations as above. Evidences of the upheaval of extensive continental land of the period, and the manner in which the Purbeck and Wealden beds were deposited.

Upper Mesozoic.

22. *Cretaceous series.*—Description of the British divisions and subdivisions. Their lithological characters and passage of Weald clay into Lower Cretaceous beds in the Wealden area and Isle of Wight. Fossils of the formations noticed in the same way as those of the Oolitic strata. The Chalk, by what organic bodies chiefly formed. Comparison with similar deposits forming in existing oceans. Nature of flints interstratified with chalk, and vein and tabular flints. Resemblances and differences of the genera and species of the Oolitic and Cretaceous epochs, and the bearings these have on lapse of time between the deposition of the Portland Oolite and the commencement of the Atherfield clay. Continental Cretaceous geology generally. Hippurite limestone. Upper Cretaceous rocks unknown in Britain. Maestricht beds and Chalk of Faxoe in Zeeland, Denmark. Upper Cretaceous beds and flora of Aix-la-Chapelle. Cretaceous strata of North and South America.

3.—Cainozoic or Tertiary.

23. *Eocene or Lower Tertiary.*—Meaning of the terms Eocene, Miocene, and Pliocene as used by Sir Charles Lyell. Grouping of greater divisions and subdivisions of the English and French strata as usually given in manuals. Areas occupied by the English and French Eocene strata. Evidence of the upheaval of the Chalk and older strata of Western Europe before the Eocene period. Fossils of the Thanet sand and Woolwich and Reading beds, of the London clay, Bagshot, Bracklesham, and Barton beds, and of the Isle of Wight and Hampshire strata from the Headon to the Hempstead beds inclusive; viz., plants, foraminifera, brachiopoda, conchifera, and gasteropoda, marine, estuarine, and fresh-water; cephalopoda, echinodermata, cirripedia, crustacea, fish, reptiles, birds, and mammalia. The evidence shown by these of the manner in which the different formations or parts of formations were deposited; 1st, into three broad divisions, estuarine and fluvio-marine below; marine in the middle; and fresh water, estuarine and fluvio-marine above. Evidences of land and its nature drawn from plants and from mammalian remains. Plants of the various subdivisions, and association of plants in Hempstead series with Eocene shells of lower beds. The nummulitic beds of England, the Continent of Europe, Asia, and Africa. Evidences of climates of Eocene times as indicated by shells, reptiles, and plants, &c. Original extension and subsequent denudation of Eocene beds in Britain. Denudation of the Weald.

24. *Miocene or Middle Tertiary strata.*—British Miocene strata and igneous rocks. Fossils of and nature of the strata. French marine and fresh-water and igneous rocks. Their fossils and the mammalia of the period. Miocene beds of the Rhine, Switzerland, Bohemia, and other parts of the Continent of Europe. Their divisions, lithological

characters, and fossils. The Alps and other lands before the Miocene epoch, and the manner in which the Swiss, Italian, and other Miocene rocks were deposited. Theory of a glacial episode during Miocene times. Mammalia. The Miocene insects and flora, especially of the British, Swiss, Icelandic, and Arctic regions. Brown coal of England and the Continent. Disturbances of the Alps and Jura before and after the close of the Miocene epoch. Miocene rocks of India and the United States and their fossils.

25. *Post-Pliocene Strata, Crag, &c.*—(See *w*, p. 98) and in addition proofs of Britain having been joined to the Continent before the Crag epoch.

26. *Glacial period and other Strata later than the Crag.*—Old land surface of Britain later than the Crag and Forest beds. Their plants, mammalia, and shells. The Glacial period. Great glaciers before the deposition of the boulder drift in the northern and southern hemispheres generally, and in Switzerland and other mountain ranges specially. The signs of this. Boulder beds and arctic shells. Minor glaciers during and after the deposition of the boulder beds. Their signs. Erosion of valleys by ancient glaciers. Theory of the formation of rock-bound basins by glaciers and of other lakes by boulder beds and eskers or kaims. General nature of the fauna of the period. Union of the British islands and their union with the continent before and after the glacial epoch. Theories of the causes that produce this glacial period and of glacial periods in general. Volcanic rocks of the Eifel. Loess of the Rhine and other rivers, brick-earths, river-gravels, and alluvia of various ages. Mammalian and other bones in these in Europe, Asia, and America. Bone caves and the manner of the preservation of their fossils. Relics of man and his works in caves, river deposits, shell mounds of Denmark, &c., and in Swiss and other lakes. Contours of ground before and after the glacial period. Pre-glacial and post-glacial valleys.

27. Theories that have been proposed to explain the distribution of life in individual formations and throughout the whole geological series, or the origin, increase, distribution, and disappearance of species and genera commonly so called. The relations of the life of successive formations to each other generally. Relations of existing faunas and floras of the world to those of Miocene, Pliocénce, and Post-pliocene age.

28. Water-bearing strata and underground drainage. Artesian and other wells. Rocks in which ores are found, and mode of occurrence of those in beds, lodes, and superficial detritus. The rules that ought to guide the miner in sinking for coal and other minerals, when the beds in which they lie are concealed by overlying and unconformable strata.

Examination for Honours.

In addition to the foregoing, candidates may be examined in any subjects treated of in standard manuals and other books mentioned below.

The following may be used as text-books:—

Principles of Geology, by Sir C. Lyell, 2 vols., 8vo., 32*s*.
(London, Murray, 10th ed., 1868.)

Elements of Geology, by Sir C. Lyell, 8vo., 18*s*.
(London, Murray, 6th ed., 1868.)

The Students Manual of Geology, by J. B. Jukes, 8vo., 12*s*. 6*d*.
(London, Longman, 2nd ed., 1862.)

The School Manual of Geology, by J. B. Jukes, 12mo., 4*s*.
(London, Longman, 1863.)
Introductory Text-book of Geology, by D. Page, 8vo., 2*s*.
(Edinburgh, Blackwood, 7th ed., 1867.)
Advanced Text-book of Geology, by D. Page, 8vo., 7*s*. 6*d*.
(Edinburgh, Blackwood, 4th ed., 1867.)
Physical Geography and Geology of Great Britain, by A. C. Ramsay, 8vo., 5*s*. (London, stamped, 2nd ed., 1864.)
Popular Physical Geology, by J. B. Jukes, 16mo., 5*s*.
(London, Routledge, 1866.)
Text-book of Geology, by J. D. Dana, 12mo., 7*s*. 6*d*.
(Philadelphia, 1864.)
Manual of Geology, by J. D. Dana, 8vo., 21*s*. (Philadelphia, 1863.)
A Handbook of Geological Terms, by D. Page, 8vo., 7*s*. 6*d*.
(Edinburgh, Blackwood, 2nd ed., 1865.)
Recent and Fossil Shells, by S. P. Woodward (Weale's series), 18mo., 5*s*. 6*d*. (London, Weale, 1851.)
Glossary of Mineralogy, by H. Bristow, 8vo., 6*s*.
(London, Longman, 1867.)

Other books that may be consulted :—

Siluria, by Sir R. I. Murchison, 8vo., 30*s*.
(London, Murray, 4th ed., 1867.)
Geological Observer, by Sir H. De la Beche, 8vo., 18*s*.
(London, Longman, 1853.)
Voyage of a Naturalist round the World, by C. Darwin, 8vo., 8*s*. 6*d*.
(London, Murray, 1845.)
The Origin of Species, by C. Darwin, 8vo., 15*s*.
(London, Murray, new ed., 1866.)
Catalogue of British Fossils, by J. Morris, 8vo., 10*s*.
(London, Van Voorst, 1843.)
Chart of the Characteristic British Tertiary Fossils, by J. W. Lowry, mounted on linen, 10*s*. (London, Stanford.)
Chart of the Genera of Fossil Crustacea, by J. W. Salter and H. Woodward, mounted, 10*s*. 6*d*. (London, Stanford.)

SUBJECT XIII.—MINERALOGY.

First Stage or Elementary Course.

A. Instruction in this subject should commence with a distinct understanding of the characters and circumstances by which minerals, properly so called, are to be distinguished from other inorganic substances, and of the position of this science in relation to the collateral sciences of physics, chemistry, and geology. Definitions of a mineral, a crystal, and of the conditions termed crystalline and amorphous. Occurrence of other more or less regular forms not crystals. Distinction of compound masses or mixtures of minerals.

B. *Crystallography*, as the essential means of appreciating the forms naturally assumed, under favourable conditions, by almost all inorganic bodies of definite composition, must commence with the needful definitions; faces, edges, and solid angles; plane figures of three, four, five, six, and eight sides; the names and chief features of the more important geometrical solid figures which occur among crystals; the object of

referring the faces to systems of axes, and the various directions in which these may be placed.

Method of drawing crystals isometrically.

Relation of the hemihedral to holohedral forms.

The grounds for grouping the various crystal forms into six systems.

Laws by which the derivation of one form from another within the limits of the same system is determined.

Complex or modified crystals may be regarded as combinations of the faces of two or more simple forms.

The leading figures of the six systems to be studied, with frequent practice in drawing.

Twin crystals and hemitropes; the relative position of the axes of their several portions.

Irregularities to which the surface of crystal faces is subject, certain angular elements remaining constant; measurement of these latter by instruments. Principles of the contact goniometer and of Wollaston's goniometer.

C. *Aggregation*, or natural grouping of—1stly, the distinctly crystallized minerals; 2ndly, of the crystalline minerals, especially with reference to structure and general form of masses of the useful minerals and of crystalline rocks.

D. *Other physical properties.*—The cleavage of crystallised substances, and its relation to crystalline form. Fracture, its various characters. Comparative hardness, how best determined. Different qualities of tenacity. Specific gravity of solids, how determined; the balance, the areometer.

Property of magnetism; what substances are capable of being attracted by a magnet, and what is the comparative intensity of the effect. Polarity. Influence of certain minerals disseminated in rocks on the correctness of surveys.

Peculiarities of smell and of taste which distinguish a limited number of minerals.

E. *Optical characters.*—Single and double refraction, and their relation to certain crystallographical systems.

Different degrees of lustre and transparency.

Colour essential in some species, not so in others; varieties of colour, how far they are capable of definition.

Phosphorescence as produced by different methods and exhibited by certain minerals.

F. *Chemical characters.*—Simple or elementary substances; some of them occur as minerals; their symbols and the derivation of the same. Equivalents; chemical combinations; principal groups of these occurring in the mineral kingdom.

Dimorphism of particular substances, accompanied by a difference in other physical characters besides form.

The employment of acids in the discrimination of minerals.

The blowpipe, its form and uses; the reducing and the oxidizing flames. Trial of comparative fusibility, of the colour given to the flame, the incrustation on charcoal; the effects of fusing various metallic oxides with beads of borax glass.

Pseudomorphism.—The phenomena presented by minerals which have the composition of one mineral coupled with the form of another. Analogous action of fossilization or petrifaction.

G. General requirements of a system of classification of minerals.

H. The physiography or systematic description of minerals. This last division should include all the more remarkable varieties as well as

species, and should take especial note of the modes and places of occurrence, as well as of the association of particular groups of minerals in certain veins or formations.

It would not be expected that the elementary course should include the description of the rarer substances, or of those species whose characters are not yet well ascertained, but attention should chiefly be given to those species which form the constituents of rocks and those which as ores supply the materials for the production of the useful metals.

Second Stage or Advanced Course.

A. Discussion of the relation of true minerals to other inorganic substances, and how far bodies of organic origin may be classed among minerals.

B. The dependence of symmetry in crystal forms on the axial system. The crystallographical value of a face is the same as that of any plane parallel to it, on the same side of the centre of the crystal. Position of the normals to a face. The methods of indicating the faces, and thence the entire forms of crystals by symbols. Drawing of a sphere of projection in which the poles of the crystal faces may be shown. Convenience of representing in a great circle the poles of a zone of faces. The magnitude of the angle between the normals being the supplement of the mutual inclination of the planes, the first kind of measurement (*i.e.* between the normals) is adopted by certain authors, and is easily reducible into the other kind. Statement of the angular and linear dimensions requiring to be determined for the description of the simple forms of all the systems after the cubical.

Twin crystals, the twin plane, and twin axes; examples of their position in important minerals of the several systems.

C. Reticulated, wiry, and capillary forms, explanations suggested for their formation. Other peculiarities in grouping.

D. The prevailing directions of cleavage in the several crystallographical systems.

Determination of the specific gravity of a substance contained in a mechanical mixture.

Electricity; by what means this property is exhibited in different minerals.

E. Refraction of light; different positions of the ordinary and extraordinary ray in doubly-refracting bodies. Optic axes of a crystal, their variation in different species of minerals.

Polarized light, its connexion with double refraction. Construction of the polariscope.

Dichroism and pleochroism, a remarkable property of some few minerals.

F. Character of the chemical composition of the more complex minerals.

The electro-negative element in chemical combinations has the preponderating effect in influencing the external character.

Isomorphism, as shown by Mitscherlich, to result from a group of—1st, isomorphous acids; 2nd, of isomorphous bases. Polymeric isomorphism of Scheerer; its meaning, and the arguments in its favour. Vicarious or irregular replacement among one another of isomorphous constituents.

Testing of minerals in the moist way simply practicable for qualitative purposes.

Treatment of various metallic ores before the blow-pipes.

Pseudomorphous substances as arranged in groups according to the nature and degree of change they have undergone.

Discussion of anogenic and katogenic pseudomorphs, or those which have been produced above by oxidizing, and below by reducing processes respectively.

Extension of pseudomorphous action on a large scale to "gossans" and to geological formations.

G. Methods of classification as proposed by the leading authors in mineralogy. Review of the difficulties caused in classification by the occurrence of the isomorphous substances.

Discussion of the means of defining a species among minerals.

H. Species and varieties of minerals as described in the best manuals. Their occurrence under various circumstances to be particularly studied. The changes in composition wrought by nature (pseudomorphous action), by which one species is converted into another, and the essential points of difference between species much alike in certain characters, will be held of much importance in dealing with the minerals of special value or interest. It is not expected that the memory should be charged with the details of substances of very rare occurrence, or of doubtful independence as species.

Examination for Honours.

The questions will as a general rule be such as are embraced in the above syllabus, but candidates will be required to prove a practical acquaintance with minerals and with crystal forms, and will need to have studied some of the more advanced works mentioned below.

As text-books may be recommended—

Elementary Course of Mineralogy and Geology, by D. T. Ansted, 8vo., 12*s*. (London, Van Voorst, 1856.)

Elements of Mineralogy, by Jas. Nicol, 12mo., 5*s*. (London, Longman, new ed., 1858.)

Manual of Mineralogy, by J. D. Dana, 8vo., 7*s*. 6*d*. (New York, new ed., 1860.)

Glossary of Mineralogy, by H. W. Bristow, 8vo., 6*s*. (London, Longman, 1867.)

For more advanced students—

Elementary Introduction to Mineralogy, by Brooke and Miller. 8vo. 18*s*. (London, Simpkin, 1852.)

Crystallography, by Rev. W. Mitchell, in Orr's "*Circle of the Sciences*." 8vo. 3*s*. (London, Griffin.)

System of Mineralogy, by J. D. Dana, 8vo., 36*s*. (New York, 5th ed., 1868.)

Elemente der Mineralogie, von C. F. Naumann, 8vo, 9*s*. (Leipzig, Engelmann, 7th ed., 1868.)

Paragenesis der Mineralien, von. A. Breithaupt, 8vo., 5*s*. 6*d*. (Freiberg, Engelhardt, 1849.)

Handbuch der Mineralogie, von W. Haidinger, 8vo., 10*s*. (Vienna, Braumüller, new ed., 1865.)

Manuel de Minéralogie, par Des Cloiseaux, Tome I., 8vo., 17*s*. (Paris, Dunod, 1862.)

Manual of the Mineralogy of Great Britain and Ireland, by Greg and Lettsom, 8vo., 15*s*. (London, Van Voorst, 1858.)

When it is intended to teach this subject with special reference to the practical working of minerals, the physiographical part will be occupied more particularly with certain of the useful species and their associated substances, and the following works may be consulted:—

The Metalliferous Deposits of Cornwall and Devon, by W. J. Henwood. 1843.

Bischof's Chemical and Physical Geology, translated by the Cavendish Society, 2 vols., 8vo., 21*s*. (London, 1854.)

SUBJECT XIV.—ANIMAL PHYSIOLOGY.

First Stage or Elementary Course.

Questions will be confined to the under-mentioned topics.

Anatomical Preliminaries.

The general build of the human body.

The meaning of the terms skull, vertebra, rib, sternum; scapula, clavicle, humerus, radius, ulna, carpus, metacarpus, phalanges (of the hand); pelvis, femur, tibia, fibula, tarsus, metatarsus, phalanges (of the foot); integument, mucous membrane, connective tissue, tendon, ligament, cartilage, muscle, nerve.

The position in the body and the general form and size of the following internal parts:—The brain and spinal cord; the pharynx, the gullet, stomach, and intestines; the salivary glands, the liver and pancreas; the posterior nares, the larynx, trachea, and lungs; the kidneys and bladder; the heart and the great vessels; the thoracic duct, and the chief lymphatic glands; the spleen; the diaphragm.

Chemical Preliminaries.

The composition of air, water, carbonic acid, and ammonia.

The chemical elements of which protein, fat, and sugar are composed.

The nature of the most important mineral compounds which are formed in the body.

The ultimate chemical products of the decay and putrefaction of the dead body.

General View of the Body in Action.

The evidence that the body constantly wastes during life; the nature of the waste products, and of the compensation for waste; the essential characters of food stuffs.

The part played by oxygen in the economy.

The number, position, and uses of the sensory organs.

The nature of cilia and the movements to which they give rise.

The physiological properties of muscular tissue. The modes in which muscles give rise to movements and sustain the body in the erect posture.

The physiological properties of nervous tissue. The general functions of the brain and of the spinal cord. Local and general death.

Special Physiology.

The circulatory Organs.—The arrangement of the chambers of the heart and of its valves. The general differences between arteries, veins,

and capillaries. The course of the circulation of the blood and the reasons why the blood moves only in one direction. The meaning of the beat of the heart, of the pulse in the arteries, and of the jet-like flow of blood from a cut artery. The evidence of the circulation obtainable in the living body.

The Blood.—The phenomena presented by blood drawn from the body. The general nature of the corpuscles of the blood. The general composition of the blood. The difference between blood and lymph.

Respiration and other processes which modify the condition of the Blood.—The obvious differences between arterial blood and venous blood. How venous can be converted into arterial blood out of the body. How and where venous is converted into arterial blood in the body.

How the air which leaves the lungs differs from that which enters them. The general nature of the respiratory movements. The course of the air, when breathing takes place through the nose. The conditions which give rise to asphyxia.

The essential composition of the urine. The general structure of the apparatus by which its separation from the blood is effected.

The essential composition of the sweat. The general structure and functions of the skin.

The manner in which the blood enters and leaves the liver. The products yielded by the liver to the blood directly, and through the medium of the alimentary canal. The chief characters of the bile. The use of the gall-bladder.

The source of the heat of the body. The manner in which the temperature of the body is distributed and regulated.

Alimentation.—The quantity of dry solid and gaseous aliments required daily by an adult man. The classification of food stuffs. The economy of a mixed diet. What becomes of proteid, fatty, amyloid, and mineral food stuffs respectively. The nature and functions of the salivary, gastric, and pancreatic secretions. The manner in which nutritive matters are absorbed, and innutritious matters excreted, from the alimentary canal.

Animal Mechanics.—The different kinds of levers and their exemplifications in the body. The nature of joints, with examples of ball and socket, hinge and pivot-joints. The conditions of the production of the voice. The difference between voice and speech.

The Senses and their Organs.—The general structure of the organ of touch. The means of measuring the acuteness of the sense of touch in different parts of the body.

The general structure of the organs of taste and of smell. The external auditory passage and the tympanic membrane. The tympanum and how it opens into the pharynx. The chain of ear bones and their connection on the one hand with the tympanic membrane, and on the other with the membrane of the fenestra ovalis. The form of the membranous labyrinth and of the cochlea. The nature of the endolymph and perilymph and of the otoconia. The relation of the auditory nerve to the labyrinth. The manner in which the impact of sound-waves on the tympanic membrane affects the auditory nerve.

The eyelids, and the manner in which they are moved. The lachrymal apparatus. The form of the eye ball; its general structure, and the functions of its component parts. The manner in which the movements of the eye-ball are effected. The blind spot. The duration of luminous impressions. Colour-blindness.

The Nervous System.—The difference between the cerebro-spinal and the sympathetic systems. The nature and functions of the roots of the

spinal nerves. The evidence that the spinal cord is capable of effecting reflex action. The nature and functions of vaso-motor nerves. The most important functional peculiarities of the medulla oblongata. The evidence that the higher faculties of the mind have their seat in the brain. The number, names, and functions of the cerebral nerves.

Second Stage or Advanced Course.

In addition to the preceding, a knowledge of the following subjects will be required :—

The Circulatory System.—The minute structure of the organs of circulation. The manner in which they are supplied with blood and with nervous energy. The pericardium.

The detailed analysis of the movements and sounds of the heart, and of the phenomena of the pulse. The causes of blushing and of pallor. The influence of the respiratory movements on the circulation. The effect of irritation of the pneumogastric nerve upon the heart's action.

The structure of the lymphatic vessels and glands, and the connexion of the lymphatic with the blood vascular system.

The Blood, the Lymph, and the Chyle.—The sizes and the structure of the corpuscles of these fluids. The phenomena which they exhibit. Their probable functions. The composition of the blood in detail. The nature of the process of coagulation.

The Respiratory System.—The structure of the thorax. The pleuræ. The structure of the respiratory organs and the distribution of the blood through them. The analysis of the respiratory movements in detail. The mechanism by which coughing, sneezing, sighing, and hiccoughing are effected. The physical and chemical processes involved in the conversion of inspired into expired air, and of venous into arterial blood. The quantity of waste products excreted and of oxygen taken in by the lungs in twenty-four hours. The rationale of ventilation.

The Urinary System.—The minute structure of the kidney, ureter, and bladder. The circulation in the kidney and the changes which the blood undergoes in passing through it. The quantity of waste products of all kinds excreted by the kidneys in twenty-four hours.

The Skin.—The minute structure of the skin, of the hairs, nails, and glands connected with it. The muscles of the hair-sacs. The quantity of waste products excreted by the skin in twenty-four hours.

The Liver.—The structure of the liver, and the course of the blood through it. The arrangement of the ducts of the liver. The composition of the bile, and the quantity of that fluid secreted daily. The functions of the bile. The nature and uses of glycogen.

The Spleen and the other Ductless Glands.—The structure and probable functions of these organs.

The Alimentary Canal.—The structure, forms, kinds, and succession of the teeth. The structure and functions of the salivary glands. The structure and functions of the tongue, the soft palate, uvula and tonsils. The pharynx and the œsophagus and the structure of their walls. The stomach, its form; the structure of its walls; its glands and their functions. The divisions of the intestine. The structure of its walls. Villi. Glands. Peyer's patches. The structure and functions of the pancreas. The peritoneum and the nature of the mesentery.

The details of the digestive and absorptive processes. The profits and losses of the economy, and how they are balanced during health.

The Muscular System and Animal Mechanics.—The minute structure of fibrous, cartilaginous, bony, and muscular tissue.

The physical, chemical, and physiological properties of muscle. Rigor mortis. The mechanism of standing, walking, running, and jumping.

The structure and working of the larynx. The mode in which consonantal and vowel sounds and articulate speech are produced.

The Senses.—The structure of the papillæ of the skin, and of the tactile corpuscles. The muscular sense. The minute structure and nervous supply of the tongue as a sensory organ.

The structure of the olfactory organ. The nature and extent of the air chambers connected with it. The minute structure of the Schneiderian membrane and of the olfactory nerve-fibres. The mechanism of smelling.

The structure of the ear. The external ear and the muscles which move it. The muscles connected with the ear bones and their actions. The minute structure of the membranous labyrinth and cochlea. The probable functions of these organs.

The minute structure and the properties of the various constituents and coverings of the eyeball. Complementary colours. Phosphenes. Purkinje's figures. Adjustment. Regulation of light. Double vision with one eye.

Sensations and Judgments.—The notion of roundness. Subjective sensations. Ventriloquism. Erect vision. Double vision and single vision with two eyes. Judgments of distance and form. The pseudoscope and the stereoscope.

The Nervous System.—The structure of ganglionic corpuscles and of nerve fibres. The structure of the investments of the brain and spinal cord. The minute structure of the spinal cord. The general disposition of the histological elements of the brain. The names and positions of the larger divisions of the brain and of its ventricles. The origins and functions of the spinal and cerebral nerves in detail. The effect of cutting the spinal cord in various ways, and of injuries to the medulla oblongata. The effect of removing the hemispheres of the brain. Unconscious cerebration and acquired reflex action.

Reproduction.—The structure of the ovum and of the spermatozoon. The process of yelk division. The formation of the blastoderm and the development therefrom of the body of the embryo, with amnion, allantois, and yelk sac. The nature of the chorion, of the decidua, and of the placenta. The mode in which the fœtus is nourished. The development of the heart and the fœtal circulation. The changes in the circulation which take place at birth. The lacteal glands and lactation. The modifications in the proportions of the body from birth to adult age. The general modifications in the condition of the skeleton from its earliest appearance. The notochord. The process of ossification. The thymus and thyroid glands. The two dentitions.

For the elementary stage—

Lessons in Elementary Physiology, by T. H. Huxley, 18mo., 4*s.* 6*d.*
(London, Macmillan, 1868.)

is recommended as a text book.

For the advanced stage, in addition to the above, the following works are recommended :—

A Manual of Physiology, by W. B. Carpenter, 12mo., 12*s.* 6*d.*
(London, Churchill, 4th ed., 1865.)

Handbook of Physiology, by W. S. Kirkes, 8vo., 12*s.* 6*d.*
(London, Walton and Maberly.)

Examination for Honours.

Candidates will be examined in any subject treated of in the standard English works upon Physiology, such as :—

Principles of Human Physiology, by W. B. Carpenter. 8vo. 26*s*. (London, Churchill, 6th ed., 1864.)

Outlines of Human and Comparative Physiology, by J. Marshall. 3 vols. 12mo. 32*s*. (London, Longman, 1867.)

SUBJECT XV.—ZOOLOGY.

N.B.—Students should have been instructed in the elements of physiology before commencing the study of Zoology. After May 1869 no candidate will be passed in Zoology unless at the same, or at a previous, examination he has been passed in the elementary stage of Animal Physiology.

First Stage or Elementary Course.

Questions will be confined to the following topics :—

The characteristic and distinctive features of the following groups of animals :—*Vertebrata, Mammalia, Aves, Reptilia, Amphibia, Pisces, Arthropoda, Insecta, Myriapoda, Arachnida, Crustacea, Annelida, Echinodermata, Rotifera, Infusoria, Spongida, Foraminifera, Cœlenterata, Hydrozoa, Actinozoa, Polyzoa, Brachiopoda, Lamellibranchiata, Pulmogasteropoda, Branchio-gasteropoda, Cephalopoda.*

(Candidates will be expected to be able to refer any British member of one of these groups to its proper group.)

The general nature and arrangement of the skeleton (or hard parts) in *Foraminifera, Spongida, Hydrozoa, Actinozoa, Brachiopoda, Lamellibranchiata, Gasteropoda, Echinodermata, Arthropoda, Vertebrata.*

The general nature and working of the alimentary apparatus observed in *Infusoria, Hydrozoa, Actinozoa, Polyzoa, Gasteropoda, Annelida, Arthropoda, Pisces, Aves, Mammalia.*

The general structure and working of the organs of circulation and respiration in *Lamellibranchiata, Gasteropoda, Crustacea, Arachnida, Insecta, Pisces, Amphibia, Reptilia, Aves, Mammalia.*

The general nature of the nervous system in *Rotifera, Echinodermata, Annelida, Arthropoda, Polyzoa, Lamellibranchiata, Vertebrata.*

The principal characters of the organs of hearing in *Lamellibranchiata, Crustacea, Pisces,* and *Mammalia;* and of the organ of sight in *Annelida, Arachnida, Insecta, Gasteropoda,* and *Vertebrata.*

The general nature of the process of development in *Hydrozoa. Lamellibranchiata, Crustacea, Insecta, Amphibia,* and *Aves.*

Second Stage or Advanced Course.

Questions may be set in all subjects enumerated under the Elementary Stage, and in addition on the following topics :—

The characters and distinctive peculiarities of the *Nematoidea, Acanthocephala, Turbellaria, Trematoda, Ascidioida* (or *Tunicata*), *Pteropoda, Radiolaria* (or *Polycistina*), *Gregarinida, Rhizopoda ;* and of the principal subdivisions (orders) of the *Mammalia, Aves, Reptilia, Amphibia, Pisces, Insecta, Arachnida, Crustacea, Annelida, Echinodermata, Hydrozoa, Actinozoa, Brachiopoda, Lamellibranchiata, Gasteropoda, Cephalopoda.*

Reference of any specimen to its proper class and order.

The most important modifications of the vertebrate skeleton observable in *Pharyngobranchii, Marsipobranchii, Elasmobranchii, Teleostei, Chelonia, Ophidia, Aves, Monotremata, Marsupialia, Cetacea, Cheiroptera, Ungulata, Simiadæ, Man.*

The leading modifications of the appendages of the body and head in the *Arthropoda.*

The structure of the test in *Echinus, Uraster,* and *Comatula* (*Antedon*).

The structure and nomenclature of the parts of the shell in *Brachiopoda, Lamellibranchiata, Gasteropoda,* and *Cephalopoda.*

The structure of the corallum in the *Actinozoa.*

The structure, succession, and chief forms of the teeth in *Mammalia.* The dental formulæ of Man, of old and new world apes; of the hedgehog, the dog, the cat, the horse, the ox, the pig, the rabbit, and the rat.

The structure and mode of formation of "whalebone."

The structure and movements of the beaks of *Aves* and *Chelonia.*

The poison fangs of snakes and the mechanism by which they are moved.

The teeth of ordinary fishes, of sharks, rays, *Chimeræ,* and lampreys.

The alimentary apparatus of the *Ruminantia,* and the mode in which it works.

The leading forms assumed by the circulatory, respiratory, renal, hepatic, and salivary organs in the animal series.

The modifications of the brain and of the sensory organs in the *Vertebata, Arthropoda, Cephalopoda,* and *Gasteropoda.*

The leading forms of the reproductive apparatus, with the general process of development, in *Mammalia, Aves, Reptilia, Amphibia, Pisces, Arthropoda, Annelida, Echinodermata, Trematoda, Tæniada, Spongida, Cœlenterata, Lamellibranchiata, Pulmo-gasteropoda, Branchio-gasteropoda, Cephalopoda.*

The distribution of animals. The principal forms of animal life characteristic of Australia; of South America, with Mexico; of Africa, south of the Sahara; of Hindostan; of Central Asia, with Europe and North Africa; of America, north of Mexico; of the Atlantic, the Indo-Pacific, the Arctic and Antarctic Oceans.

The broad facts relating to the succession of animal life upon the globe.

The natural history of the animals which supply articles of commerce.

Examination for Honours.

In this examination questions will be set at the discretion of the Examiner, who will have regard to the state of Zoological teaching in the country and the means of acquiring information.

SUBJECT XVI.—VEGETABLE ANATOMY AND PHYSIOLOGY.

First Stage or Elementary Course.

Distinctions between flowering and flowerless plants. Growth of flowering plant from seed. Plumule, radicle, cotyledons.

Ascending and descending axis: axial and appendicular organs.

Cells: Parenchyma, prosenchyma, ducts, spiral vessels. Vascular bundles.

Structure and growth of root. Spongioles.

Structure of exogenous stem. Pith, wood, bark, medullary rays.
Epidermis. Hairs, prickles.
Nature, position, and development of leaf buds: branches and spines.
Venation and structure of leaves. Stomates.
Floral organs, protective and essential. Sexes of plants.
Structure and dehiscence of anthers. Structure of pollen grain. Evolution and course of pollen tube.
Stigma. Ovule: nucleus and coats, foramen. Anatropous campylotropous and orthotropous ovules. Impregnation. Embryo sac.
Seed: hilum, chalaza, rhaphe. Albumen. Embryo: monocotyledonous and dicotyledonous.
Food of plants. Course of sap, osmose, exhalation, respiration (by day and night), assimilation. Cambium layer.
Composition of cellulose, starch, sugar, gum, gluten, chlorophyll.
In the earlier course these subjects should be taught quite generally, as they occur in the ordinary type of structure. All exceptions should be reserved for the higher course.

Second Stage or Advanced Course.

Cell development by division and free cell formation. Protoplasm. Formation of ducts and vessels.
Cell contents. Cytoblast or nucleus, secondary deposits, air, crystals, rhaphides, chlorophyll, oil.
Circulation of fluids in cells.
Functions of cells and vessels. Intercellular spaces, latex canals.
Structure of trunk of climbing plants, and of tree ferns.
Parasitical plants; leafy and leafless, on root, stem, bark.
Development of leaves.
Abnormal forms of stomates.
Pollen formation.
Ovule of Loranthaceæ.
Impregnation and embryogeny of Conifers and their allies.
Reproduction of Cryptogams.
Propagation of plants otherwise than by seed.
Physiology of flower; absorption of oxygen, evolution of heat.
Irritability of leaves, tendrils, stamens.
Theory of manures.
Differences between animals and plants.

Examination for Honours.

Questions at the discretion of the examiner, who will have regard to the state of learning in the country and the means of acquiring information.

SUBJECT XVII.—SYSTEMATIC AND ECONOMIC BOTANY.

First Stage or Elementary Course.

A.—Morphology.

Ascending and descending axis.
Root: annual, biennial, perennial; fibrous, tuberous, tap, &c.
Stem: woody or herbaceous; erect or creeping; corm, bulb, rhizome.

Leaf: entire or variously cut; simple or compound; kinds of composition. Petiole, blade.

Stipules. Tendrils. Bracts.

Inflorescence: raceme, spike, catkin, umbel, capitulum, corymb, panicle.

Flower: complete or incomplete, uni- or bi-sexual; regular or irregular.

Calyx and corolla: poly- or gamo- sepalous or petalous; persistent or deciduous; valvate, imbricated or twisted in estivation.

Stamens: number and relative position; insertion, cohesion. Filament, anther.

Ovary: adherent or free; of one or more carpels, uni- or multi-locular; number and cohesion of styles.

Ovules: solitary or numerous; erect, horizontal, or pendulous; with axile, free central or parietal placentation.

Fruit: dehiscent or indehiscent; succulent or dry; drupe, berry, achene, capsule, legume, pod.

B.—Classification.

Dicotyledones: thalalamifloræ, calycifloræ, corollifloræ, incompletæ.
Monocotyledones.
Acotyledones: acrogens, thallogens.
Distinctive characters of the largest British natural orders, viz.:—

Ranunculaceæ.	Scrophulariaceæ.
Cruciferæ.	Labiatæ.
Caryophylleæ.	Orchideæ.
Leguminosæ.	Liliaceæ.
Rosaceæ.	Cyperaceæ.
Umbelliferæ.	Gramineæ.
Compositæ.	

C.—Economic Botany.

The candidate will be expected to know the economic plants indigenous to Great Britain and Ireland, as well as those contained in the following list:—

Wheat.	Gum.	Teak.
Barley.	Caoutchouc.	Maple.
Oats.	Gutta Percha.	Walnut.
Rye.	Turpentine.	Opium.
Rice.	Palm oil.	Quinine.
Indian corn.	Cocoanut oil.	Jalap.
Pea.	Castor oil.	Ipecacuanha.
Bean.	Olive oil.	Aloes.
French bean.	Indigo.	Rhubarb.
Pasture Grasses.	Logwood.	Senna.
Clover.	Madder.	Nutmeg.
Turnip.	Catechu.	Cloves.
Mangold.	Galls.	Pepper.
Hops.	Oak bark.	Orange.
Tea.	Cotton.	Vine.
Coffee.	Flax.	Almond.
Cocoa.	Hemp.	Peach.
Chicory.	Jute.	Plum.
Tobacco.	Mahogany.	Melon.
Starch.	Oak.	Cucumber
Sugar.	Deal.	Gourd.

The use of the product, the part of the plant affording it, the name and natural order of the plant which yields it, its native country when wild, and when cultivated the area of cultivation will be expected to be known.

Second Stage or Advanced Course.

Modifications of stem structure (as in cactus, &c.)
Modifications of leaf structure: Phyllodes, pitchers.
Morphology of cryptogams: frond, thallus, theca or spore-case, sorus elater, mycelium, spore, &c.
Phyllotaxis.
Theory of Inflorescence.
Metamorphosis of flowers.
Dimorphism of flowers.
Principles of classification.
Natural family or order, genus, species, variety.
Variations of cultivated plants.
Characters of all British natural orders, and of the largest and most important exotic orders.
Classification of Cryptogams: characters of ferns, Lycopodiaceæ, Equisetaceæ, mosses, Hepaticæ, Characeæ, Algae, Lichens, Fungi.
Principal economic plants belonging to each natural order.
General principles of geographical botany.

Examination for Honours.

Questions will be set at the discretion of the examiner, who will have regard to the state of botanical learning in the country and the means of acquiring information.

SUBJECT XVIII.—PRINCIPLES OF MINING.

The Art of Mining embraces so wide a field of study that equal practical proficiency in its various branches is not to be expected from persons engaged in different classes of mines, nor equal knowledge of its general features from students brought up in districts where only one or another branch of the subject is practised. The examination papers will therefore contain a sufficient variety of questions to suit candidates belonging to either a metalliferous or a coal district.

The subject at large being properly an art, or application of various branches of science, and one in which every question will admit of various degrees of proficiency being shown in the replies, the higher numbers will be awarded only to those answers which exhibit the greater amount of completeness and accuracy. Curt and vague answers will be but of little value, and exactness will be expected in all that relates to numbers, prices, weights, and measures.

Those who wish to gain a general knowledge of the topics for examination may be recommended to direct their attention to the subjoined heads, viz.:—

First Stage or Elementary Course.

1. Geology and Mineralogy, more particularly those portions of the sciences which bear on the following subjects,—the nature and position in the earth's crust of the useful minerals, the classes of

rock with which they are severally associated, the special character of heaves, throws, troubles, and all kinds of dislocation; the particular differences between beds and lodes, and their minerals, and the chief features of irregular repositories.

2. The methods of prospecting and searching at surface for ores and other minerals.
3. Breaking rock by manual labour alone; various forms of pick, and of hammer and wedge employed for the purpose. Use of gunpowder and other explosives; precautions to be observed in boring and in firing shots.
4. Depths attained by mines and bore holes in various cases. Geographical distribution of the chief mining districts.
5. Ventilation of mines, why important. Composition of air, carbonic acid gas, and fire-damp; how the latter noxious damps occur, and what precautions against them should be adopted, either for a temporary purpose or permanently. Reasons of a natural circulation of air to some extent being observable in all mines. Various applications of water to aid ventilation. Means of applying heat, or machines for the same purpose.
6. Lighting of workings; principle and construction of the safety lamp.
7. Circumstances under which water enters mines. Working of ordinary pumps; special requirements of pumps for mines. Mode of applying human or horse labour to the winding of water and stuff or mineral; fixing and comparison of the unit of work. Water wheels and steam engines, variety and construction of, as in use for mining purposes.

   Carriage or conveyance along levels and inclines; barrows, tram-plates, rails, tubs, or wagons.

   General features of winding in shafts by machinery.
8. The form and dimensions of shafts applied to various purposes; sinking, and precautions against accident from falls and from collapse of sides.
9. Driving of levels, drifts, and wind-roads; their rate of inclination, breadth, and height in various districts; methods and cost of arching them, and of timbering or wooding.
10. The removal or *exploitation* of mineral after completion, to a certain point, of dead work; stopes and pitches, under various circumstances. Pillar-working at various depths, and other forms of extracting coal or ironstone. Main considerations of safety and economy which have to be studied in adopting a particular plan.
11. Means of security to be adopted in shafts; 1st, as to construction and fixing of ladders; 2nd, as to rules and arrangements where the men ride instead of climbing.

Second Stage or Advanced Course.

1. Details as to the form in which the useful minerals are accumulated; stratified deposits; alluvial or stream-works; lodes and their various directions; pipes and other irregular repositories. Examples of remarkable localities; true sectional drawings or profiles to be studied. Examples of heaves, and alleged laws according to which they have taken place. Composition and physical state of the containing rock or "country."
2. Exploring, shoading, and costeaning. Grounds for opinion in the re-opening of old mines; preliminary operations in virgin districts.

3. Breaking of ground; the various implements employed, their form, dimensions, and weight; boring for shots; the various modes of firing charges. Heavy charges, how calculated and fired; rules for ensuring safety. Drilling and coal-cutting machines.
4. Deep boring, under what circumstances applicable,—apparatus for; description of varieties in use; lining of bore-holes.
5. Management and supervision; payment of men employed at mines, at surface and underground, varying in principle with the different classes of operation; reasons for tut-work or piece-work, and tribute or bing-tale under different circumstances. Calculations for cost of driving, sinking, tramming, &c.
6. Physical principles of ventilation; practice of mines where simple natural ventilation is employed; ventilation of large areas and of deep or complicated workings by guiding the natural current; artificial means, and their details, for promoting ventilation. Precautions to be taken under specially dangerous conditions.
7. Illumination, of various kinds, their economy; safety lamps in all their best modifications; circumstances under which they should be employed; precautions in their use.
8. Mechanical division of the subject. Strength of materials used in mines; human and horse power, principles and construction of machines to which they are applied. Hydraulic machines; construction of the water-wheels, turbines, and pressure engines most suitable to the various operations of mining. Steam engines, for pumping and for winding; arrangement and construction of the varieties most in use. Form and dimensions of boilers. Pumps employed in mines, mode of placing them; construction of the lifts; materials and details of the rods, set-offs, counterbalances, cisterns, and catches. Circumstances under which dams are erected in shafts or levels; mode of building them.

   Tubbing of water from shafts; conditions under which it may be done; details of the operation with various materials, wood, brick, stone, cast and wrought iron.

   Rails, waggons, and tubs for underground conveyance; employment of horses and of fixed steam engines for this purpose.

   Raising of the mineral through the shafts; various methods in use; chains, ropes (of hemp or wire), their weight, &c. Details of the best application of drums, cages, guides, keeps, and safety doors. Pulleys and shaft frames or poppet heads; protection against overwinding; safety clutches, &c. in case of breakage of rope.
9. Opening of ground; quarries and open work; driving of levels, various dimensions and directions according to circumstances; sinking of shafts, inclined or perpendicular; advantages of either kind under certain conditions; means of securing levels and shafts by timber or by walling; details of the various methods. Driving or sinking in heavy or running ground.
10. Working excavations; plan of laying them out, and means of security to be adopted whilst they are kept open. This will include the stoping of metalliferous veins, and the various modifications of post and stall, long-work, &c., which are applied to stratified deposits.
11. Travelling in shafts; prevention of accidents by proper fitting and dividing; mode of placing ladders and sollars; lifting machine for men, construction and advantages of.
12. Dressing of minerals. Arrangement of dressing floors. Construction of crusher and stamps; washing of coal; jigging, concentration, and separation of metallic minerals.

Examination for Honours.

Questions will be set at the discretion of the Examiner, who will have regard to a general knowledge of mining as carried on in this and other countries, and may require certificates from employers as to practical work.

The student may be advised among other sources of information to consult the following works:—

Manual of Geology, by J. Phillips. 8vo. 12*s*. 6*d*. (London, Griffin, 1855.)

Laws regulating the Deposition of Lead Ore in Veins, by W. Wallace. 8vo. 25*s*. (London, Stanford, 1861.)

Treatise on Mining Engineering, by G. C. Greenwell. 4to. 50*s*. (London, Spon, 1856.)

Coal and Coal Mining, by W. W. Smyth. 8vo. 7*s*. 6*d*. (London, Strahan, 1869.)

Metallic Wealth of the United States, by J. D. Whitney. 8vo. 16*s*. (London, Trübner, 1854.)

Géologie Appliquée, par A. Burat. 2 vols. 8vo. 17*s*. (Paris, Langlois, 4th ed., 1859.)

Die Lehre von den Erzlagerstätten, von B. von Cotta. 2 vols. 8vo. 15*s*. (Leipzig, Felix, 2nd ed., 1861.)

Besides these the various reports of H. M. Inspectors of Coal Mines, and the evidence given before Committees of the Houses of Parliament on *Accidents in Mines*, may be studied with advantage.

SUBJECT XIX.—METALLURGY.

For the first stage or elementary course the student will be expected to answer questions under the following heads, exclusive of those in italics.

The second stage or advanced course will include these. The student will also be required to make sketches and name unlabelled specimens.

For honours the candidates will be asked questions at the discretion of the Examiner, who will have regard to the present state of metallurgical science as carried on in this and other countries.

Introductory Subjects.

Physical Properties of Metals.—Physical State. Action of Heat. Specific Gravity. Crystallization. Varieties of Fracture. Malleability. Ductility. Tenacity. Toughness. Softness. Elasticity. Conduction of Heat and Electricity. Capacity for Heat. Expansion by Heat. Opacity. Lustre. Colour.

Classification of Metallurgical Processes.—Explanation of the terms ore, "native" veinstuff, matrix or gangue, "dressing." Reduction. Smelting. Flux and Slag. Regulus. Speise. Roasting. Distillation. Sublimation. Liquation.

Slags.—Atomic constitution of silicates. Constitution, external characters, brittleness, toughness, colour, and fusibility of slags. The fusibility of certain compounds not containing silica, aluminates, &c.

Sesquioxide of iron and lime. Fluor spar as a flux. *Melting points of silicates as indicated by the fusion of alloys of gold and platinum. Supposed sulphosilicates.*

Natural Refractory Materials employed in the Construction of Crucibles, Retorts, Furnaces, &c. Fire Clays.—Approximate composition. Mode of testing. Crucibles.—Earthen or clay crucibles. *Stourbridge clay crucibles. Cornish crucibles. London crucibles. Hessian crucibles. French crucibles. Belgian crucibles.* Graphite, black-lead, or plumbago crucibles. Lining crucibles with carbon. Furnaces.—Sefström's blast furnace. *Deville's blast furnace.* Fire Bricks, &c.—Stourbridge fire-brick. Dinas fire-brick. Sand and sandstones.

Fuel.

The calorific power of fuel. Berthier's process of estimating the calorific power of fuel. The calorific intensity of fuel, and theoretical computation. Wood.—Kinds of wood employed as fuel. Elementary composition of dry wood. Proportion of water in wood. Specific gravity of wood. Proportion and approximate composition of the ashes of wood. The rapidity of growth of wood. Weight of wood. Cutting and storing of wood intended as fuel. Peat or Turf.—Specific gravity of peat. Composition of peat. Approximate composition of the ashes of peat. *Proximate composition of peat.* Extraction and desiccation of peat. Coal.—Definition of coal. Approximate composition of the ashes of coal. Lignites. *Classification of lignites according to external characters.* Approximate composition of lignites. Bituminous coals. Caking coal. Free burning coal. Cannel coal. Anthracite. *Fibrous and granular matter in coals.* Composition of bituminous coals to be given generally and approximately for each class. *The occurrence of certain metals in peat and coals. Frémy's chemical researches on combustible minerals.* Charcoal.—*Specific heat* and specific gravity of charcoal. Proximate composition of charcoal. Various modes of charcoal burning. Charcoal burning in piles or stacks. *Chinese methods of charring in pits.* Yield of charcoal by volume and by weight. Influence of temperature upon yield. *Theory of charcoal burning in circular and rectangular piles.* Peat charcoal or coke. *Carbonisation by superheated steam.* Coke.—Properties of coke. Approximate composition of coke. Presence of water in coke. General principles concerning the preparation of coke. Coking in circular piles, in long piles or ridges, and in large open rectangular kilns. Coke ovens. *Cox's coke oven. Coke oven of the Brothers Appolt. Composition and economic application of the waste gases of coke ovens. Davis' Breezeoven. Mineral charcoal.* Coking of non-caking coal slack by admixture with pitch. *Collection of products of economic value generated during the process of coking.* Desulphurization of coke. Combustible Gases.—Carbonic oxide. Hydrogen. Hydrocarbons.

Comparison of fuels in regard to calorific power. *Calorific power calculated from ultimate composition.*

Copper.

Physical and chemical properties. Specific heat. *Linear dilatation by heat.* Action of heat. Atomic weight. Action of oxygen. Dioxide; protoxide; dioxide and protoxide of copper heated with silica. *Borates of copper.* Disulphide. Disulphide of copper heated with access of air. Theory of the process of heating disulphide of copper with free access of air, or roasting. Disulphide of copper heated in admixture with dioxide, protoxide, or sulphate of copper. *Dioxide of*

copper heated with protosulphide of iron and silica. Disulphide of copper exposed to the action of hydrogen and water at high temperatures. Metallic copper exposed to the action of the vapour of water at high temperatures. Disulphide of copper heated with carbon, with iron, with zinc, with lead, with tin, with antimony. Copper heated with tersulphide of antimony. Disulphide of copper heated with nitre, with caustic soda, with carbonate of soda, with baryta or lime, with cyanide of potassium. Copper and dioxide of copper. Copper and carbon. Overpoled copper. Copper and nitrogen. Copper and phosphorus. Copper and arsenic. Copper and silicon. Specific gravity of copper. *Electric conductivity of copper. Influence of various foreign matters on electric conductivity.*

Ores of Copper.—Physical characters and chemical composition of: Native copper. Red oxide of copper. Black oxide of copper. Green carbonate of copper or malachite. Blue carbonate of copper. Vitreous or grey sulphide of copper. Purple copper ore. Copper pyrites or yellow copper ore. True grey copper ore or fahlerz. Chrysocolla. Atacamite. Copper ores of Cornwall and Devon. *Meaning of the word Standard.*

Assaying of copper ores by dry and wet methods. Comparative results by Cornish and wet methods.

Copper Smelting.—In Reverberatory furnaces: The Welsh Process.—Furnaces employed; calciner, melting furnace. The reactions which occur in the process. Calcination; *composition of the gaseous products which escape from the ore-calciner.* Melting of the calcined ore; external characters, and composition of coarse metal and ore-furnace slag. *Specific gravity of the coarse metal and ore-furnace slag.* Calcination of the granulated coarse metal; Melting of calcined granulated coarse metal; white metal, blue metal, metal-slag. Moss-copper. Roasting; blister-copper, roaster-slag. *Best selected process.* Refining. *Elimination of the following Foreign Metals during the Welsh Process of Copper Smelting.—Arsenic, antimony, tin, nickel, cobalt, gold, and silver. Various proposed improvements in Copper Smelting Furnaces. Napier's process. Method of smelting proposed by MM. Rivot and Phillips. Smelting rich copper slags in a blast furnace.* In Blast Furnaces: In Japan. In Sweden.—Furnaces employed; ore-furnace, black copper furnace, refining-hearth. The processes of roasting or calcination, fusion of the roasted ore, roasting of the regulus from the last operation, fusion for black copper, refining, and toughening. Copper rain. Loss in smelting. *Smelting of copper schist in Prussian Saxony. Copper smelting in Perm in Russia. Cupriferous pig iron. Theory of the process. Kernel-roasting at Agordo.—Composition of the ore. Roasting. Styrian kilns. Mode of charging. Changes which the ore undergoes during roasting. Theory of the process. Wet methods of extracting copper:—Precipitation of copper from solution by iron. Bankart's process. Wet process by M. Escalle. Häkner's patent. Loss of copper.* Impurities occurring in commercial copper.

Zinc or Spelter.

Physical and *chemical* properties. Atomic weight. Action of oxygen. Action of water on zinc. Oxide of zinc. Reduction of oxide of zinc by carbon, carbonic oxide, and hydrogen. *Silicates of zinc. Reduction of silicate of zinc by carbon. Oxide of zinc heated with boracic acid.* Sulphide of zinc heated with access of air, with oxide of zinc, *with carbon, with various metals, in the vapour of water, with carbonic acid,* with nitre or nitrate of soda, with carbonate of potass or soda, *with lime.* Zinc and phosphorus. Zinc and arsenic.

Ores of Zinc.—Physical character and chemical composition of: Calamine. Electric calamine. Blende. *Red zinc ore.*

Methods of assaying Ores of Zinc.

Methods of Extracting Zinc.—*English Process.—Roasting or calcination of the blende. Pots and condensing tubes. Reduction house. Mode of making the pots. Mode of charging the pots, and management of the furnace. Treatment of the rough zinc.* Silesian Process.—Retorts and appendages. Clay nozzles or condensers. Laggins or stoppers. Iron appendages. Description of the furnace. Calciner. Distillation of zinc. Melting of distilled zinc. Belgian Process.—Retorts and appendages. Description of the furnace. *Carinthian Method. Zinc fume. Montefiori furnace.* Foreign matter in commercial zinc. *Proposed improvements in the extraction of zinc.*

Brass.—Definition. Malleability. Process of stamping. Dead-dipping. Physical properties of various alloys of copper and zinc. Manufacture of calamine brass. Direct preparation of brass. Muntz's metal. Defects occurring in brass. Colouring and lacquering.

Iron.

Physical and Chemical Properties. Magnetism. Tenacity or tensile strength. Specific heat. *Dilatation by Heat.* Action of heat. Welding. "Burnt Iron." Crystalline and fibrous iron. Effect of cold hammering upon iron. Atomic weight. Iron and oxygen.—Protoxide; sesquioxide or red oxide; hydrated sesquioxide; magnetic oxide; iron scale, or hammer slag. *Ferric Acid.* Iron and Water.—Preservation of iron from rust. Iron and Sulphur.—*Disulphide;* protosulphide; *protosulphide exposed to the action of vapour of water at a high temperature. Protosulphide of iron heated with carbon, with sesquioxide of iron, with sulphate of protoxide of sesquioxide of iron, with protoxide of lead, with other metallic sulphides, with silica, with silica and carbon. Sesquisulphide;* bisulphide; or iron pyrites. Magnetic pyrites. Sulphate of protoxide of iron, copperas, or green vitriol. *Neutral tersulphate of sesquioxide of iron.* Sulphides of iron roasted with access of air. Iron and Nitrogen.—Results of experiments. *Passivity of iron.* Iron and Phosphorus.—Phosphides of iron. *On the action of carbon on iron containing phosphorus.* Phosphate of protoxide of iron. Phosphate of sesquioxide of iron. *On the action of iron at a high temperature upon phosphate of lime in the presence of carbon.* Ditto in the presence of carbon and free silica. *On the action of phosphorus on iron containing sulphur. Iron and Arsenic. Case-hardening of iron or steel by arsenic.* Silicon. *Silicon and nitrogen.* Manganese and Silicon. Iron and Silicon.—Reduction of silica by carbon in the presence of oxide of iron and other bases. Protoxide of iron and silica. Reduction of silicate of protoxide of iron by carbon. *Silicate of sesquioxide of iron. Tribasic silicate of protoxide of iron heated with access of air. Liquation of silicate of protoxide of iron containing phosphorus. Protoxide of iron and boracic acid. Sesquioxide of iron and boracic acid.* Iron and Carbon.—Modes of effecting the combination of carbon with iron. Cementation. *Action of carbonic oxide upon iron. Action of solid carbon upon iron. In an atmosphere of carbonic oxide. In an atmosphere of hydrogen.* Amount of carbon in iron. Maximum amount of carbon capable of being taken up by pure iron. *Iron, manganese, and carbon.* Modes of existence of carbon in iron, grey, white, and mottled cast iron. Chill-casting. Spiegeleisen, or specular cast iron. *Action of silicon and of sulphur on iron containing carbon. Abstraction of silicon from cast iron by fusion with sesquioxide of iron alone, and with the addition of manganese.* Carbonate of protoxide of iron. *Action of dilute sulphuric or hydrochloric acid on white and grey cast iron.* Action of sea water on cast iron.

Alloys of Iron.—Iron and copper. Iron and zinc. Process of zincing

or galvanizing iron. Iron, copper, and zinc. Keir's patent. *Aich-metal. Sterro-metal.* Iron and tin. *Hardening the tops of rails with tin. Stirling's patent. Action of tin on cast iron.* Iron and manganese; *titanium; lead; bismuth; nickel; cobalt; mercury; silver; gold; platinum; rhodium; aluminium; chromium; tungsten.*

Ores of Iron.—Physical properties and chemical composition of:—Magnetic oxide of iron, magnetite. *Franklinite.* Red hæmatite, red ore or anhydrous sesquioxide of iron. Brown hæmatite, brown iron ore, or hydrated sesquioxide of iron. Spathic carbonate, or sparry iron ore. Argillacious iron ores, clay or clayband ironstones.

Assaying of iron ores by dry and wet methods.

Direct Extraction of Iron in the Malleable State from the Ore.—Iron Smelting in India, Burma, Borneo, Africa, and Madagascar. Catalan Process; trompe, or blowing machine. *Its advantages and disadvantages.* Water wheel, hammer, and anvil. *Theory of the process. Conditions affecting the quality of the iron produced.* Characters of the iron produced. *The Osmund furnace.* Stückhofen or High Bloomery Furnace. *Clay's process. Renton's process. Chenot's process.* Indirect Extraction of Iron in the State of Cast Iron from the Ore.—*Swedish charcoal blast furnace; mine kiln. Pressure of the blast. Temperature of the blast. Iron ores employed. Most important iron mines in Sweden. Smelting of lake and bog iron ores in Sweden.* Description of the modern blast furnace; foundation, hearth, twyer openings, twyer, tunnel head, bracing, blast main, and blast pipes, *blast engines.* Cinder tubs. *Chemical phenomena of the modern blast furnace.* Hot Blast.—Neilson's patent. When first put into operation. Apparatus for heating the blast. *Neilson's first apparatus. Cast-iron tubular oven.* Syphon pipe, *box-foot pipe, spiral pipe, and pipe-within-pipe oven. Gas oven. Round or oval oven. Theory of the hot blast.* Saving of fuel. *Water-twyers.* The Gases of Iron-smelting Blast Furnaces.—Composition of the gases of the Furnace. *Production of cyanogen in the blast furnace. Temperature of the blast furnace at different depths.* Utilization of the gases escaping from blast furnaces. "The waste gas." Modes of taking off the gases with open-mouthed and with close-mouthed furnaces. *Solid matter carried over with the waste gas.* The best form of the blast furnace. Decrease in volume which the materials undergo during their descent. Elliptical furnace. *Rectangular or Rachette furnace. Blowing in a blast furnace.* Tapping. Sand-bed for casting. Derangements in the working, scaffolding, and slips. Loss of iron in the slag. *Indications afforded by colour of slags. Spontaneous disintegration. Potash in slags. Accidental products of blast furnaces. Silica. Furnace cadmia or calamine. Cyanonitride of titanium. Graphite or kish.* Reduction of phosphoric acid in the blast furnace, and passage of the phosphorus into the pig iron. Economical application of blast furnace slags. *Effects of long continued heat upon sandstone in the hearth bottom. Substitution of lime for limestone as a flux. Application of chloride of sodium.* Explosions in blast furnaces. Poisoning by gas accidentally escaping from blast furnaces. Yields of blast furnaces.

Various kinds of Pig Iron.—Spiegeleisen. Pig iron made from magnetic iron ore. Do. from red hæmatite. *Do. from brown hæmatite. Pig iron produced exclusively from Northamptonshire ore.* Do. wholly or chiefly from argillaceous iron ore of the coal measures. *Yorkshire. Derbyshire. South Staffordshire. North Staffordshire. South Wales. Do. from Cleveland ore. Titaniferous pig iron.*

Production of Malleable Iron from Cast Iron.—South Welsh process; the hollow fire. Swedish Lancashire Hearth; *Walloon process, as conducted in Sweden. Carinthian process.* Slags or cinders produced in finery processes. Running out fire or refinery; composition of refined

iron; do. refinery slags or cinders. Puddling; puddling furnace. Invention of iron bottoms; manipulation; theory of the process; composition of tap cinder; invention of the boiling process; double puddling furnaces. *Mechanical puddling. Application of waste blast furnace gas to puddling. Siemens' gas puddling furnace; principle of the furnace. The gas producers. Construction. Puddling with dried wood. Stamping and assorting puddled balls. Utilization of the waste heat of puddling furnaces.* Working of the Ball.—Forge hammers; tilt hammers. Helves or lift hammers. *Steam forge hammers; Nasmyth's. Condie's.* Squeezers; crocodile. Horizontal rotary. Vertical rotary. *Brown's shingling machine.* Puddling or puddle rolls. *Composition of puddled bars.* Working of the Puddled Bar into Merchant or Finished Iron.—Reheating furnace; with coal as fuel. With gaseous fuel, or gas-welding furnace. Piling. Accidents in rolling mills. *Yield of puddled and finished iron.* Manufacture of rails. *Composition of the cinder from the reheating furnace.*

Varieties of Sheet Iron and Slit Rods.—Tin plates. Charcoal plates. *Coke plates. Belgian sheets. Russian sheets. Slit rods.* Special Qualities of Iron.—South Yorkshire. Process of manufacture at Low-moor, Bowling, and Farnley. South Staffordshire. *Swedish iron. Dannemora. Russian iron.* Boat plates. *Armour plates; rolled; hammered. Mending broken rolls.*

Permanent expansion of cast iron by exposure to long continued heat at or above redness. Dilatation of cast iron by heat.

Production of Steel.—By the Addition of Carbon to Malleable Iron: In the direct reduction of iron ores at one operation. In the Catalan process. In crucibles. In converting furnaces. Carburization of iron as a distinct process; carburization of pulverulent iron. *Chenot's process.* Carburization of bar iron. Converting furnace. *Carburization by gaseous compounds of carbon.* Carburization by fusing compact iron with carbonaceous matter; *Hindoo process. Wootz. Mushet's steel.* By the partial Decarburization of Cast Iron:—By fusing in hearths. *By puddling.* Composition of puddled steel. *Uchatius process.* By cementation. By Fusion of Pig Iron with Malleable Iron:—*Immersion of malleable iron in molten cast iron.* By Blowing Atmospheric Air through Molten Pig Iron.—Bessemer process. Description of the apparatus. *Parry's process of manufacturing iron and steel.* Casting of Steel.—Furnaces and crucibles. Fusion of steel in the reverberatory furnace. *The addition of manganese in the casting of steel.* Manipulation of Steel.—Hardening and tempering steel. *Metallic baths for the use of working cutlers.* Theory of hardening and tempering steel. Hammering steel. Welding steel. Shear steel. *Casting steel on wrought iron. Damaskeening.*

LEAD.

Physical and Chemical Properties. *Dilatation by heat. Conductivity for heat and electricity.* Action of heat. Autogenous soldering. Action of air, of water, *of carbonic acid, of dioxide of copper, and of acids upon lead.* Protoxide; mode of formation by dry and *wet* methods. Physical characters of massicot and litharge. Action of heat. Action of carbon, *of hydrogen, and of carbonic oxide.* Fusibility with metallic oxides. *Action of metals when heated with protoxide of lead. Dioxide;* Binoxide; mode of formation. *Sesquioxide;* Red lead; process of manufacture. Physical and *chemical* properties. Action of heat. *Action of acids.* Sulphide; physical and chemical properties. Action of heat and air upon sulphide of lead; in the presence of iron pyrites and of blende. *Action of hydrogen and of steam upon sulphide of lead.* Action of protoxide

of lead, silicates of protoxide of lead, *of alkalies, of carbonate of soda, of* cyanide of potassium, of alkalies and alkaline carbonates and carbon, of lime and carbon, *of peroxide of iron and carbon*, of nitrate of potash, *of chloride of sodium*, of iron, *of tin*, and *of copper* when heated with sulphide of lead. Combination of sulphide of lead with other sulphides. *Subsulphides of lead.* Sulphate; physical and *chemical* properties. Action of heat. Action of carbon, of iron, of lead, of protoxide of lead, of sulphide of lead, *of chloride of lead*, of silica, of lime, of *chloride of sodium*, and of cyanide of potassium, upon sulphate of lead. *Sulphate of lead and fluor spar.* Lead and Phosphorus. Phosphide; phosphates. Lead and Arsenic. Action of arsenious acid on lead. Arseniate of lead. Silicates of Protoxide of lead. Methods of formation. Fusibility. Action of carbon, of sulphur, *of sulphide of iron*, of iron, *of lime, of lime and carbon*, of peroxide of iron and carbon upon silicates of protoxide of lead. *Silicates of protoxide of lead and potash. Silicates of protoxide of lead and lime. Silicates of protoxide of lead, lime, and alumina. Borates of protoxide of lead.* Carbonate; white lead. Action of heat.

Alloys of Lead.—Lead and antimony; zinc; *copper; mercury; gold;* silver.

Ores of Lead.—Physical character and chemical composition of: Galena or sulphide of lead. Cerusite, or carbonate of protoxide of lead. Angleaite or sulphate of protoxide of lead. Pyromorphite or phosphate of protoxide of lead. Mimetisite or arseniate of protoxide of lead. Minerals occurring with galena.

Methods of assaying Lead Ores.

Extraction of Lead from the Ore.—In air furnaces: Old English process. *Peruvian process. Spanish process.* In blast furnaces: *Hindoo process.* Ore hearth.—Construction of the furnaces, method of working, nature of the products, *chemical composition of the products and chemical reactions which occur in the process. American ore hearth.—Peculiarity. Advantages.* German method with iron, or "precipitation process."—Description of furnaces, mode of working, nature of the products, *chemical composition of the products and chemical principles involved. Composition of lead speise.* Smelting of regulus. German method with silicate of protoxide of iron, or iron refinery slags. In reverberatory furnaces: Derbyshire furnace.—Process, description of the furnace, nature and *composition of the products and chemical reactions involved.* Flintshire furnace.—Process, peculiarities, nature of the products, *chemical composition of the products and chemical reactions which occur. Action of lime.* Cornish process.—Description of "calciner," and of "flowing furnaces." Nature of the products. *Chemical composition of products. Action of iron.* Bleiberg process.—Peculiarities of the process, character of furnace. Method of working, nature of the products and *chemical composition of products. Modifications of process.* Smelting of lead slags: Slag hearth.—Description of furnace, mode of working, *composition of products and chemical reactions involved.* Spanish slag hearth.—Description of furnace, mode of working, nature of products and *chemical composition of products.* Smelting of lead fume. Reduction of litharge. Softening of hard lead. Smelting of sulphate of protoxide of lead ore. *Composition of the products.*

Extraction of Silver from Lead.—Pattinson's process.—*Theory of the process*, methods of working, description of the apparatus and mechanical appliances. *Limit of concentration. Effect of foreign metals.* Parkes' process.—Methods of working. *Principles involved.* English process of cupellation.—Construction of furnace, mode of conducting the process, nature of the products, *chemical composition of the products and chemical reactions involved.* German process of cupellation (abtreiben).—Description of furnace, mode of conducting the process,

nature of the products and *chemical composition of products*. Refining of "Blicksilber."—In open test. Under a muffle.

Apparatus for condensing Lead Fume. Physical properties and *chemical composition* of lead fume. Varieties of Lead in Commerce. Impurities occurring in lead. *Methods of testing for metals present in lead*.

Silver.

Physical and chemical properties. *Dilatation by heat. Conductivity for heat and electricity. Specific heat.* Action of heat, of heat and air, of nitre, *of chloride of sodium, of oxide of copper*, of protoxide of lead, *of sulphate of protoxide of copper*, and of acids upon silver. Silver and Oxygen. Protoxide; physical and chemical properties. Methods of producing. Action of heat. Action of carbon. *Action of chlorine.* Silver and Sulphur. Sulphide; physical and chemical properties. Modes of formation. Action of heat. Action of heat and air. Action of heat and air in the presence of iron pyrites, copper pyrites, *disulphide of copper, blende, and galena. Action of hydrogen, of steam*, of acids, of nitre, of iron, of lead, *of copper, and of mercury upon sulphide of silver*. Combination with other sulphides. *"Oxidized silver" process.* Sulphate; physical and chemical properties. Mode of producing. Action of heat. Action of chloride of sodium. Mode of formation of compound of sulphide and sulphate of silver. *Solubility in water. Sulphite;* hyposulphite; method of preparation. *Action of hydrochloric acid upon.* Action of hyposulphite of soda on chloride of silver. Nitrate; physical and chemical properties. Action of heat. Method of separation from nitrate of protoxide of copper. *Action of carbon and phosphorus upon solutions of.* Silver and Chlorine. Chloride; physical and chemical properties. Methods of formation by dry and wet processes. Methods of reduction by carbonate of soda, by carbonate of lime, by zinc. *Action of hydrogen*, of acids, of chloride of sodium, *of cyanide of potassium*, of iron, lead, *copper, tin, antimony, arsenic, mercury*, of sulphur, of metallic sulphides, and of protoxide of lead upon chloride of silver. *Silver and bromine. Silver and iodine. Silver and phosphorus. Silver and arsenic.*

Alloys of Silver.—Silver and lead; copper; gold; *zinc; palladium; antimony*.

Ores of Silver.—Physical characters and chemical composition of: Native silver. Silver glance or sulphide of silver. Sulphide of silver and copper. Antimonial silver. Ruby silver or sulphide of silver and antimony. Brittle silver glance. Sulphide of silver and arsenic. Polybasite. Sulphide of silver, antimony, and lead. Horn silver or chloride of silver. *Bromide of silver. Iodide of silver. Nature of metalliferous minerals containing silver.*

Assaying of ores and alloys of silver by the dry and wet methods.

Methods of Extraction.—Extraction of silver from argentiferous copper: Liquation process, or "Saigerarbeit."—Description of furnace. Mode of operation. Nature of the products. *Chemical principles involved.* Extraction of silver from the ore: Mexican amalgamation process.—Apparatus employed, materials used, method of working, nature of the products and *chemical principles involved. Specialties of the process.* Working of the silver amalgam. *Application of copper amalgam. Loss of silver in the process. Chloride of silver process.* Freiberg amalgamation process.—Description of furnaces and apparatus, Mode of working and *chemical principles involved. Composition of silver amalgam.* Method of separating the silver from the amalgam. *Amalgamation of argentiferous speise. Amalgamation of argentiferous copper*

regulus. Extraction of silver from argentiferous regulus: Ziervogel's process.—Description of the furnaces and apparatus employed, method of operation, nature of the products, and *chemical reactions involved in the various operations. Specialties of the process.* Augustin's process.—Description of the process and *chemical principles involved.* Von Patera's method.—Apparatus used, materials employed, products obtained, and *chemical reactions in the process.* Extraction of silver from ore by means of lead: Furnaces used, method of working, nature of the products. *Chemical composition of the products and chemical reactions involved.* Methods of plating or silvering: Old methods. On copper. On steel. Method of silvering without the use of "batteries." *Stripping of silver plate.*

Varieties of silver in commerce. Metals occurring in silver. *Methods of testing silver for foreign metals.*

Gold.

Physical and chemical properties. Dilatation by heat. *Conductivity for heat and electricity.* Action of heat. *Protoxide; physical properties, mode of preparation, action of hydrochloric acid.* Teroxide; physical and chemical properties. Protosulphide; methods of formation, physical characters. Tersulphide; mode of producing, physical characters, action of heat, *of chlorine, of hyposulphite of soda, and of potash upon tersulphide of gold. Gold and phosphorus. Gold and arsenic.* Gold and chlorine; *protochloride;* terchloride; methods of formation. Action of oxalic acid, of sulphate of protoxide of iron, *of terchloride of antimony and of chloride of arsenic* on solutions of chloride of gold. *Preparation of purple of Cassius. Method of colouring "ruby glass."*

Alloys of gold.—Gold and copper; *zinc;* silver; lead; *tin; antimony; iridium; platinum; palladium;* copper and zinc; silver and copper.

Use of the touchstone. Definition of the terms "standard" and "carat."

Ores of Gold.—Native gold; physical character and chemical composition. *Various metalliferous minerals containing gold.* Auriferous quartz.

Assaying of ores and alloys of gold by dry and wet methods.

Methods of Extraction.—Amalgamation of quartz containing gold; apparatus employed, mode of working, nature of the products, and method of extracting the gold from the amalgam. *Longmaid's process. Anossow's process by means of iron. Plattner's process by chlorine.* Melting of gold dust. Sweep refining.

Separation of Gold from Silver and Copper. Parting.—Dry methods: *By litharge and sulphur.* By cementation; description of the process. *Chemical reactions involved. By sulphur.* Wet methods: Nitric acid process; apparatus used, method of working, and *chemical principles involved.* Sulphuric acid process; apparatus employed, mode of working, and *chemical reactions involved. Modifications of the process. Refining gold containing silver by chlorine.*

Varieties of Gold in Commerce. *Methods of detecting copper, silver, lead, tin, antimony, platinum, palladium, and iridium in gold.*

Mercury or Quicksilver.

Physical and chemical properties. Action of heat, of air, *of acids, and of chlorine upon mercury. Suboxide; physical and chemical properties.* Protoxide or red oxide; mode of formation, physical and *chemical* properties. Action of heat. *Subsulphide; physical and chemical properties.* Protosulphide or vermilion; methods of preparation, physical and

chemical properties. Action of heat, of heat and air, *of hydrogen*, of iron, of lime, *of alkalies, of chlorine, and of acids upon protosulphide.* Subchloride; physical and *chemical* properties. Protochloride; physical and *chemical* properties.

Amalgams.—Mercury and silver; gold; copper; *iron;* sodium.

Ores of Mercury.—Physical characters and *chemical composition* of: Native mercury. Cinnabar. *Native amalgan. Fahlore containing mercury. Nature of other minerals containing mercury.*

Methods of assaying of ores of mercury.

Methods of Extraction.—Description of furnace, method of operation, nature of the products, and *chemical reactions involved* in the following methods: *Huanacavelica process. Almaden process. Idrian process.* Leopold furnace process. Alberti process. Hähner's furnace process. *Gallery furnace process. Fahlore process.*

Impurities present in mercury. Methods of testing mercury for foreign metals. Modes of purifying commercial varieties of mercury. Water gilding.

COBALT.

Physical and *chemical* properties of the metal. Methods of preparation. Protoxide; mode of formation, physical and *chemical* properties. *Action of hydrogen.* Sesquioxide; methods of preparation, physical and *chemical* properties. *Action of carbon.* Physical and *chemical* properties and mode of producing the compounds of cobalt and arsenic. *Arseniate of cobalt.*

Ores of Cobalt.—Physical character and *chemical composition* of: Cobalt glance. Smaltine. *Cobalt bloom. Nature of other minerals containing cobalt.*

Methods of estimating cobalt.

Cobalt products.—Smalts; mode of preparation. Apparatus used. Nature of the products. *Chemical composition of the products. Chemical principles involved* in the manufacture. Uses of smalts and oxide of cobalt. Silicate of protoxide of cobalt; mode of obtaining. Physical characters. *Rinmann's green; mode of preparation. Nature of. Chemical composition. Thenard's blue; mode of preparation. Nature of. Chemical composition. Phosphate of cobalt.* Printers' blue; application. Mode of preparation. Nature of. *Chemical composition.*

NICKEL.

Physical and *chemical* properties of the metal. Physical and *chemical* properties of protoxide and peroxide of nickel. *Action of hydrogen. Action of carbon.* Physical and *chemical* properties and mode of obtaining compounds of nickel and sulphur. Physical and *chemical* properties of the compounds of nickel and arsenic. Nickel speise; *chemical composition. Pottery nickel. Action of heat and air upon arsenide of iron, cobalt, and nickel.*

Alloys of Nickel.—German silver; mode of preparation, physical characters and composition of the commercial varieties. *Nature and composition of other alloys containing nickel.*

Ores of Nickel.—Physical characters and *chemical composition* of: Kupfernickel. Nickeliferous pyrites. Arsenical nickel. Nickel glance. *Millerite. Nature of other minerals containing nickel. Meteoric iron.*

Methods of assaying nickel ores.

Methods of Extraction.—Apparatus employed, mode of working, nature of the products, and *chemical reactions involved.*

Commercial varieties of nickel. *Foreign metals occurring in nickel.*

Arsenic.

Physical and *chemical* properties. Action of heat, and of heat and air upon the metal. Physical and *chemical* properties, and methods of preparation of the compounds of arsenic and oxygen. *Action of light.* Action of heat. Action of carbon, of *hydrogen,* and of *carbonic oxide upon arsenious acid.* Physical and *chemical* properties, and methods of obtaining the compounds of arsenic and sulphur. Action of heat, *of carbonate of soda and carbon, and of cyanide of potassium upon the sulphides of arsenic.*

Ores of Arsenic.—Physical characters and *chemical composition* of: Native arsenic. Realgar. Orpiment. Mispickel. Arsenical iron pyrites. *Nature of other minerals containing arsenic.*

Methods of estimating arsenic.

Methods used for obtaining White Arsenic.—Description of apparatus, methods of working, nature of the products and *chemical reactions involved.* Methods of refining white arsenic; description of apparatus, mode of working, and nature of products. *Preparation and chemical composition of yellow arsenic glass. Preparation and chemical composition of red arsenic glass.* Preparation of metallic arsenic.

Applications of arsenic and its various compounds. Nature and *chemical composition* of Emerald Green and *Scheele's green. Opalescent glass. Mode of producing Green bronze.*

Antimony.

Physical and *chemical* properties of the metal. Physical and *chemical* properties, and methods of formation of the following oxides of antimony:—Teroxide; action of carbon, *of cyanide of potassium,* and of sulphur, upon teroxide of antimony. Intermediate oxide. Antimonic acid; action of heat. Tersulphide; methods of formation. Physical and *chemical* properties. Action of heat, of heat and air, *of steam,* of carbon, of *carbonic oxide,* of cyanide of potassium, of nitre, of iron, of *copper,* of *tin,* and *of acids* upon tersulphide of antimony. Glass of antimony. Liver of antimony.

Alloys of Antimony.—Antimony and lead. Action of heat and air upon alloys of antimony and lead. *Antimoniates of protoxide of lead. Naples yellow.* Composition of type metal and stereotype metal. *Antimony and iron; copper;* "*Regulus venus*" tin. *Other alloys containing antimony used in the arts.*

Ores of Antimony.—Physical characters and *chemical composition of: Native antimony.* Antimony glance. Valentinite. Antimony ochre. *Red antimony ore. Nature of other minerals containing antimony.*

Assaying of ores of antimony.

Methods of Extraction.—Apparatus used, methods of working, nature of the products, *Chemical composition of the products,* and *chemical reactions involved* in the following methods:— Liquation process. Reduction by iron, English process. French method.

Foreign metals occurring in antimony. Methods of testing for foreign metals.

Tin.

Physical and *chemical* properties of the metal. Action of heat, of air, of heat and air, and *of acids* upon the metal. *Action of tin on various metallic oxides.* Physical and *chemical* properties of the following:— Protoxide; *Sesquioxide;* Binoxide; "*Putty powder.*" *Stannate of soda.* Physical and *chemical* properties of the following:—Protosulphide; *Persulphide; Protochloride; Perchloride.* Tin and Arsenic.

Alloys of Tin.—Tin and copper. Physical properties and composition of bronze, Bell metal, and Speculum metal. Casting of Bronze. Tin and antimony. Britannia metal. *Tin and zinc.* Tin and lead. Pewter. Solder. Soldering. *Tin, lead, and copper. Roman pot metal. Other alloys employed containing tin. Bearing metal. Amalgam for electrical machines. Tin bronze. Tinning of brass pins.*

Ores of Tin. — Nature and *chemical composition* of Cassiterite. "Stream tin." "Mine tin." "Wood tin." *Tin pyrites or bell-metal ore. Minerals occurring with tin ores.*

Assaying of tin ores.

Smelting of Tin Ores.—In reverberatory and blast furnaces. — Description of furnaces used, methods of working, nature of the products, *chemical composition of the products, and chemical reactions involved.* Refining of tin. *Oxland's process.*

Commercial Varieties of Tin.—Common tin. Refined tin. Grain tin. Block tin. *Foreign metals occurring in tin. Methods of testing for foreign metals.*

Bismuth.

Physical and *chemical* properties. Action of heat, of air, *of steam, and of acids* upon bismuth. Teroxide; mode of formation. Physical and *chemical* properties. Action of carbon. *Protoxide.* Tersulphide; methods of formation. Physical and *chemical* properties. Action of heat. *Action of hydrogen. Action of metals when heated with Tersulphide of Bismuth.*

Alloys of Bismuth.—Nature and composition of alloys containing bismuth employed.

Ores of Bismuth.—Names of various minerals containing bismuth. *Physical characters and chemical composition of minerals containing bismuth.*

Methods of estimating bismuth.

Methods of Extraction.—Apparatus used. Description of processes, *and chemical actions involved in the various methods. Old methods.* Recent methods. Plattner's furnace.

Foreign metals occurring in bismuth. Methods of testing for foreign metals.

Platinum.

Physical and *chemical* properties of the metal. *The properties of Platinum black and Spongy platinum, and methods of formation.*

Ores of Platinum.—Native platinum. Physical characters. *Metals occurring in. Minerals associated with.*

Methods of Extraction.—Wet method. Deville's method. Melting of platinum. *Working of platinum.*

SUBJECT XX.—NAVIGATION.

First Stage or Elementary Course.

General Notions.—Figure of the earth; earth's diameter, axis, poles. Meridians; equator, equinoctial. Parallels of latitude; latitude, longitude. Difference of latitude; difference of longitude. Rhumb line; course; nautical distance, meridian distance; departure.

Examples of differences of latitude and longitude. The meridian distance is equal to the difference of longitude multiplied by cosine of

latitude. When a ship is sailing on a parallel of latitude :— (1), given the distance made good and latitude to find the difference of longitude; (2), given the difference of longitude and the latitude to find the distance; (3), given the meridian distance and the difference of longitude to find the latitude.

The Compass.—Description ; Points. Number of degrees, minutes, and seconds in a point, ¼ point, ½ point, ¾ point. To reduce points and parts of points into degrees, minutes, and seconds, and conversely.

Variation of the Compass: easterly, westerly. How to be allowed (1) when it is required to find the true from compass course; (2), to find compass course from true.

Causes of Local Deviation.—How the amount of local deviation is ascertained practically; how allowed. Examples of correction of courses for variation and deviation.

Leeway.—Definition. Starboard tack, port tack, close-hauled. How leeway is to be allowed. Examples.

The Log.—Description. How divided.

Plane Sailing.—Construction of figures. Proof of formulæ used in plane sailing, viz., connecting nautical distance, difference of latitude, departure and course. Examples.

Traverse Sailing.—Definition of a traverse. To resolve a traverse. Construction of traverse table. Examples.

Middle Latitude Sailing.—To prove the formulæ used. Examples.

Second Stage or Advanced Course.

Mercator's Projection and Chart.—Description. How meridians are laid down, and divided for representation of the latitudes. Chief value of the chart is :—" That the angle which a straight line joining any two " places on a chart makes with the meridians is equal to that which the " rhumb line joining the same two places on the globe makes with the " meridians ": proof of this.

To draw a Mercator's chart. To find the latitude and longitude of any place on the chart, and *vice versâ,* from the latitude and longitude to find its place on the chart. To find the course between two places on the chart. To find the ship's place by the bearing of two known places or headlands. To lay down a rock, island, or headland from observed bearings. To find the distance between two places on the chart. From the course and distance run to find the place on the chart.

Proofs of rules used in Mercator's sailing. Examples.

Local Deviation.—More accurate account of the causes of sub-permanent and induced magnetism. Laws of induced magnetism in a ship. Semicircular and quadrantal deviation. Description of modes for ascertaining the amount of deviation.

Great Circle Sailing.—Given the latitude and longitude of two places to find the distance between them on a great circle. To find also the latitude and longitude of the vertex. To find a succession of points on a great circle between two places. Examples.

Errors to which the log is liable. Having given the apparent distance run with given known errors in log line and glass, to find the true distance.

To find the difference of longitude made on a traverse. Sea journal. Taking a departure. Log-board and log-book. Day's work. Examples.

Examination for Honours.

In addition to the above there will be required—

The proof of the rule for finding meridional parts, viz.:—

$$m = 3{\cdot}8988495 + \log.\ (\log.\ \cot.\ \tfrac{1}{2}\ \text{colat.} - 10):$$

Problems in Marine Surveying, &c.

Candidates for examination in this subject are recommended to use the following books :—

A Treatise on Navigation and Nautical Astronomy, by J. Riddle (*with Tables*), 2 vols., 11*s.* 6*d.* Tables separate, 5*s.*
(London, Simpkin & Marshall, 8th ed., 1864.)

Navigation and Nautical Astronomy, by H. W. Jeans, in two parts, 12mo., 5*s.* each, or in one vol. 9*s.*
(London, Longman, new ed., 1860.)

Or, *Navigation and Nautical Astronomy*, by Merrifield & Evers.
(London, Longman & Co.)

Nautical Tables from British Seamen, by James Inman, 8vo., 14*s.*
(London, Rivington, 1862.)

SUBJECT XXI.—NAUTICAL ASTRONOMY.

First Stage or Elementary Course.

Definition.—Circles of declination or hour circles. Equinoctial points. Ecliptic, obliquity of ecliptic, signs of the zodiac. Precession of the equinoxes, circles of celestial latitude. Latitude and longitude of a celestial body.

Declination, right ascension, right ascension of the meridian, sensible and rational horizon. Zenith, nadir, vertical or azimuth circles or circles of altitude. Altitude, azimuth, and amplitude of a heavenly body. Parallels of altitude. Six o'clock hour circle. Prime-vertical. Colatitude.

Proof that the altitude of the elevated pole is equal to the latitude of the observer. Illustration by diagrams; projections on the meridian and horizon.

Time. Apparent noon, apparent solar day, mean solar day, mean noon, equation of time. Sidereal day. To convert intervals of mean time into sidereal time, and *vice versâ.* Illustration of these definitions by diagrams. Difference between civil and astronomical reckoning of time. To convert arc into time, and time into arc.

To find the Greenwich date, the time at any other place and longitude being given. To take out the right ascension of the mean sun for a given mean Greenwich date.

The corrections of altitudes :—

1. *Dip.*—Proof that dip in minutes $=\cdot 9784\sqrt{h}$, h being reckoned in feet.
2. *Refraction.*—Why necessary? Show generally how it is measured. Refraction $=57''$ tan ZD nearly.
3. Correction for semi-diameters.
4. *Parallax.*—Horizontal parallax $\times$ cos. apparent altitude $=$ parallax in altitude.

Sextant.—Description. Adjustments, how to make them. Index error, how it may be found.

Chronometer.—Error and rate. Reading of the chronometer.

Equation of time.—How it is to be applied to the mean time to obtain the apparent time, and conversely.

To find the latitude by a meridian altitude of the sun: proof of the rule and examples. To find the latitude by a meridian altitude of a star.

By the moon :—

1. To find the mean time, and Greenwich date, of the moon's meridian passage on a given astronomical day in a given altitude.
2. To find the semidiameter and horizontal parallax of the moon for a given Greenwich date (mean time) from the Nautical Almanac.
3. To take out the moon's declination from the Nautical Almanac.
4. To find the altitude by the meridian altitude of the moon. Examples.

To find the mean time at any place and also the Greenwich mean time of the passage of a star over a given meridian on a given day, and the distance at which it passes north or south of the zenith. To find the latitude by the altitude, (1), of the sun; (2), of a star; (3), of the moon below the pole. To find the latitude by the altitude of the pole star. To find the variation or local deviation by the observed azimuth or amplitude of the sun. Proof of the rules for finding the azimuth and amplitude. Applications of the rules to find the variation or deviation.

To find the hour angle of a heavenly body east or west of the meridian. To compute the mean or apparent time at any place from the observed altitude of a heavenly body. To find the error and rate of the chronometer. To find the longitude by the chronometer.

Second Stage or Advanced Course.

For the advanced course, in addition to the above, the candidate will be required :—

To compute the reduction of the horizontal parallax.

To define the angle of the vertical, and to describe the method of computing it.

To compute the augmentation of the moon's semi-diameter.

To prove the following rules :—

1. For the reduction of the altitude of any celestial body observed at one place to what it would have been if observed at the same instant at another place.
2. For finding the latitude by the altitude of the pole star.
3. For finding the latitude by altitudes of any celestial body near the meridian.
4. For finding the hour angle of a celestial body from the observed altitude.
5. For finding the rising and setting of celestial bodies and twilight.
6. The error of hour angle for small errors in observed altitude, when least.
7. For finding the latitude and longitude by means of two altitudes.
8. For computing the altitude of a given celestial body for a given time.
9. The method of clearing a lunar distance from the effects of parallax and refraction.

And to work practical examples of all these rules.

To compute the latitude and longitude by double altitudes—1. By Ivory's method. 2. By the direct method.

To find the error of the chronometer by equal altitudes of the sun or of a fixed star. To compute the apparent altitude from the true altitude. To compute the longitude by an observed lunar distance. To describe Summer's method for finding latitude and longitude. Cyclones and tides.

Examination for Honours.

In addition to the above :—

Method of computing the moon's right ascension from an occultation of a fixed star. Longitude by eclipses of Jupiter's satellites. To find

the position of an unknown star or comet by its distances from two known stars. Astronomical problems.

For studying this subject the same books are recommended as have already been given at the end of the courses on *Navigation*.

SUBJECT XXII.—STEAM.

First Stage or Elementary Course.

In the first paper the questions will be restricted to those portions of the syllabus comprised under the heads numbered 1, 2, and 3, or 1, 2, and 4 respectively, and the students will be expected to possess a fair elementary knowledge of the subject.

Second Stage or Advanced Course.

In the second or advanced paper the questions will bear upon those portions of the syllabus numbered 1, 2, 3, and 5, or 1, 2, 4, and 5 respectively, and a more exact knowledge of details will be expected.

Examination for Honours.

The range of subjects will be the same as in the advanced course, but the questions will extend over that portion comprised under the sixth head of the syllabus.

1. *Introductory Matter.*—The expansion of bodies by heat, the liquid and gaseous states of matter, the co-efficient of expansion, energy of the atomic forces, practical illustrations of the expansion and contraction of various substances; the temperature of bodies, instruments for measuring temperature, the thermometer, comparison of thermometers when differently graduated, pyrometers; the capacity of bodies for heat, the calorimeter; the conversion of work into heat and of heat into work, the consumption of heat in liquefaction and vaporization; the convection of heat, the method in which a large mass of water may become heated; the conduction of heat, good and bad conductors, experimental illustrations; the formation of vapour and steam, the boiling points of fresh and salt water, the causes which influence the boiling temperature of water, high-pressure steam, measure of steam pressure by atmospheres, steam when in contact or not in contact with water, the relation between the pressure, density and temperature of steam, the specific gravity of steam, the latent heat of steam, the quantity of water required to produce condensation, common and superheated steam, the analysis of sea water.

   The radiation of heat, the absorption of heat, the general relation between radiation and absorption, good and bad radiators of heat, experimental illustrations.

   The oxidation of metals, the effects of galvanic action.

2. *Steam Engine.*—Newcomen's atmospheric pumping engine, its defects; the discoveries of Watt, the separate condenser, the expansive working of steam, its economy, its value in regulating the power of an engine.

Details connected with Watt's single-acting pumping engine; the steam cylinder, the valves connected with it, their action, the condenser, the air-pump, the foot valve, the delivery valve, the snifting valve, the hot well, the piston rod, stuffing boxes and glands, the parallel motion; the method of starting the engine, and of regulating its speed, the cataract.

The double-acting condensing beam engine, the principle upon which it works; details of the various parts, the cylinder, how constructed, the ports or openings into the cylinder, the forms of slide valve in common use, the locomotive or three-ported valve, the lap on a valve, the eccentric, the lead of a valve, cushioning the steam, clearance, details of the piston, metallic packing-rings; the expansion valve, and the gear connected with it; the air-pump, condenser, the supply of water for condensation, blowing through, gauges for the condenser, the barometer gauge, method of estimating pressure by it, errors in this method, and correction of the same; the connecting rod, the strap gib and cutter, the parallel motion, the governor, the fly-wheel.

The principle of an equilibrium valve, the double beat valve, the crown valve, the throttle valve, the gridiron valve.

The high-pressure engine without condensation, the expansive principle as applied in the double cylinder condensing engine.

The forms of boiler in common use: the Cornish boiler, the cylindrical boiler with internal flues, the vertical boiler, heating and fire-grate surfaces, the evaporative power of boilers, boiler chimneys; the strength of boilers, the use of stays, the proving of boilers. Boiler appendages; safety valves, reverse or atmospheric valves, communication or stop valves, the glass water gauge, steam pressure gauge, various forms, Bourdon's gauge, feed pumps.

3. *The Locomotive Engine.*—The general construction of a locomotive engine and boiler before the invention of Stephenson, the Killingworth engine; description of the Rocket engine by R. Stephenson as the type of the modern locomotive, the tubular boiler, the draught produced by the discharge of waste steam.

The arrangement of an engine, the cylinders, their position, steamways, ports, slide valve, water cocks, grease cocks, the piston and packing-rings, piston-rod, guides, connecting rod, eccentrics, the reversing or link motion, reversing lever, sector, expansive working, crank axle and driving wheels, power required for traction, adhesion of the driving wheels, counter weights to cranks, wheels and axles, axle-boxes, bearing springs, buffer and draw springs, friction brakes.

Details of the boiler; the fire-box, the inner and outer shell, ribs on the crown of the fire-box, the cylindrical barrel, the tubes, mode of fixing them, through tie rods, the ashpit, the smoke box, the blast pipe, mechanical action of the blast, the steam chest, the outer dome, the steam pipe, the regulator, safety valves, pressure gauges, whistles, blow-off cocks, feed pumps, Giffard's injector; evaporative power of the boiler, fire-grate and heating surface, combustion of fuel; the tender, water-tank, brake, feed pipes.

The permanent way; varieties of rails in common use, timber sleepers, transverse and longitudinal systems; jointing of rails, the fish joint; the tyres of wheels, their form, general description of switches and crossings.

4. *The Marine Steam Engine.*—Side lever engine, the oscillating engine for paddle-wheel steamers, the vertical trunk engine; the Gorgon engines, the object of this arrangement; other forms of engine. Engines for screw propellors, direct acting engines with or without

multiplying gear, Penn's trunk engine, Maudslay and Field's return connecting-rod engine.

Details of parts connected with the working of a marine engine; the air pump bucket and valves, double-acting air pump, India-rubber disc valves, cylinder escape valves, bilge and feed pumps, expansion valves, expansion cams and gear. The method of reversing an engine when fitted with a single eccentric, reversing by a double eccentric, the link motion. Paddle wheels, feathering of the floats, disconnexion and immersion of wheels. The screw propeller, various forms, length, angle, pitch, and area of screw blade, disconnecting and raising the screw, the position of the screw propeller in the vessel, the slip of the screw, the method of receiving the thrust upon the vessel, soft metal bearings.

The marine tubular boiler, how constructed, gun-boat boilers, the steam-chest, fire-bridge and ashpit, the funnel and its casing, waste-steam pipe, water gauge, gauge cocks, pressure gauges, safety valves, reverse valves, stop valves, feed pumps, boiler hand-pumps, feed or donkey-engine, Kington's valves, blow-out cocks, brine-pumps and brine-valves, the methods of ascertaining the degree of saltness of the water in a boiler, amount of saltness permissible, formation of scale, superheating apparatus, surface condensation.

Practical working; getting up the steam, filling the boilers, laying the fires, attention to various parts of the engine while the steam is getting up, mode of starting, working the engines at moorings. Priming; its causes and remedies. Duties to machinery when under steam, boilers, fires, &c. Injection pipes. Kingston's valves. Leaks in engines. Bearings of engines. Expansive working. Management of fuel. Damages and repairs to boiler, &c., after accidents. Duties to engine, &c., on arriving in harbour.

5. *Calculations.*—Methods of measuring the efficiency of steam engines. The duty of an engine. The horse power. Mercantile or nominal horse power.

The indicator; the ends it fulfils, description of the instrument, the atmospheric line. Method of taking a diagram. The general configuration of diagram to be expected under various circumstances. Examination of the indicator-diagram when the steam is throttled; when expansive gear alone used, and in other cases. To ascertain the horse-power of an engine by means of the indicator. The indicator-diagram in a high pressure or locomotive engine.

The principle of the parallel motion of a beam engine.

6. *Calculations.*—Estimation of the work done in one stroke of the piston, the same taking clearance into account. To find the horse power from the evaporation in the boiler. De Pambour's theory. Velocity of maximum useful effect. To find the evaporation of a condensing engine of given dimensions and horse power, the piston moving with a given velocity with and without expansion. To find the pressure in the cylinder, knowing the effective evaporation. To find the diameter of a cylinder to work at a certain speed, knowing the evaporation. To find the evaporation in the boiler, knowing the diameter and velocity of the piston and the pressure of steam in the cylinder with and without expansion. The same for locomotive, Watt's engines, &c.

The screw—to find its area, to find also the angle of the helix or thread of the screw propeller, and the pitch. The power exerted by a screw. How far the slip depends on the form and dimensions of the screw. Motion of the paddle-wheels, &c. Consumption of fuel. Measure of the locomotive performance of marine steam engines. To find the angle the crank has moved through when the piston is

at a given distance from the top of the stroke. Amount of work developed by the crank in a half-revolution. Length of the radius-bar in a side lever engine. Work done in the up and down stroke of the air pump. The best temperature for the condenser of a steam engine. Qualities of fuel, &c.

Diagram showing the relative motions of the slide and piston at every point of the stroke.

Dynamometer: to find horse-power of engine by means of it.

The text books specially recommended are—

Treatise on the Marine Steam Engine, by T. J. Main and T. Brown, 8vo., 12*s.* 6*d.* (London, Longman, 5th ed., 1865.)

On the Indicator and Dynamometer, by T. J. Main and T. Brown, 8vo., 4*s.* 6*d.* (London, Longman, 1857.)

Catechism of the Steam Engine, by J. Bourne, 12mo., 6*s.* (London, Longman, 1868.)

And for reference—

Railway Locomotives, by D. K. Clark, 2 vols., folio, 70*s.* (Edinburgh, Blackie, 1856–60.)

Treatise on the Steam Engine, by J. Bourne, 4to., 42*s.* (London, Longman, 5th ed., 1861.)

Examples of Modern Steam, Air, and Gas Engines, by J. Bourne, Part I., 4to., 2*s.* 6*d.* (London, Longman, 1868.)

SUBJECT XXIII.—PHYSICAL GEOGRAPHY.

First Stage or Elementary Course.

For this stage or course it will be expected that the student shall understand and be able to express the simple facts of the science and explain the terms in common use. The following outline may be useful to the teacher as well as to the student:—

1. The form and motions of the earth. Its division into land and water. Size and shape of continents. Low lands, their position and the names by which they are known. High lands or plateaux. Hills. Mountains and mountain systems. Valleys.
2. The ocean and its extent. The names given to different parts. Its depth where known. Its saltness. The movements of the ocean. Marine currents. Waves.
3. Rivers and river systems. Lakes.
4. The air, its nature, extent, and principal uses. Permanent winds. Periodical winds. Storms.
5. Dew. Clouds and rain. Snow and hail. Nature of climate.
6. The nature of earthquakes. The nature of a volcano. Earthquake bands and bands of volcanic action. The simple phenomena of a volcanic eruption.
7. The mode in which plants and animals are distributed on the earth. The mutual relations of horizontal and vertical distribution. The meaning of representative species and the principal groups of plants and animals that represent others in different continents and large islands.
8. The different races of men. The mode in which they are now distributed on the earth.

The examination questions set in this elementary paper will not involve more than a knowledge of such facts as are taught in the ordinary text books.

For a *mere pass* it will only be required that the answers should be so far correct and definite as to show that reasonable care has been taken in explaining the subject, assuming ordinary intelligence and exertion on the part of a young pupil. For a *first class* in this stage sound elementary knowledge and clearness of definition will be indispensable.

SECOND STAGE OR ADVANCED COURSE.

The more advanced students, who come up in the second stage, will not pass without exhibiting something more than mere elementary knowledge. They must have a knowledge of principles as well as facts. They will be expected to have acquired—

a. So much elementary astronomy as relates to the position of the earth in the solar system, its magnitude and rotation, and the influence of the sun, moon, and other bodies distributed through space on terrestrial phenomena.

b. So much of elementary physics and inorganic chemistry as includes the nature and mode of action of the physical forces and the composition of rocks.

c. So much of elementary geology and mineralogy as includes a knowledge of the nature of rocks, their superposition, succession, and disturbances.

d. So much of palæontology as includes a knowledge of the distribution of life in time.

The bearing of these departments of knowledge on physical geography commonly so called should be understood. The terms used in them must be well appreciated and briefly defined when definitions are asked.

The following outline of the main subjects included in physical geography will show the nature of an advanced course of instruction.

1. Land. Relation of continents and islands. Protuberance of land and preponderance of land in one hemisphere. Form of extremities of land. Grouping of islands. The geographical axes of the two continents. Influence of the form of a coast line. Characteristic features of the various great masses of land.
2. Mountain axes and mountain systems. Details of the great mountain systems of the world, especially with regard to the continents. Relations of the different parts of the great mountain system of Europe and Asia. Isolated mountains and mountain system of Africa. Mountain system of America. Culminating points. Knots in mountain chains.
3. High plains or plateaux; their nature and position. Their relations with the geographical axes and to geographical structure. Examples of plateaux. Plateaux in small islands. Sierras or mountain ridges rising from plateaux. The drainage of plateaux by deep narrow valleys.
4. Low plains; their distribution and relation to high plains and mountains. The low plains of the principal natural divisions of the world. The steppes of Asia. Deserts of Africa and Arabia. Savannahs and prairies of North America. Silvas, Llanos, Pampas of South America. The characteristics of each. Valleys; their varieties and peculiarities. Difference between mountain valleys and the valleys of plateaux.

7. Water; its position on the earth. Natural divisions caused by the protuberance of parts of the earth. Oceans and inland seas.

Depth of the ocean, and means of ascertaining its depth. Nature of the ocean floor. Form of the bottom of the ocean. Solid contents of water. Density of water under different circumstances. Effect of cold on water. Temperature of the sea. Colour of water.

8. Motion of water. Waves. The tidal wave. Currents. The principal stream currents. Drift currents. Irregular movements of water. Sargasso seas.
9. Circulation of water by rivers. Drainage areas and river basins. Nature of water sheds. Origin of rivers. Floods and flood moderators. River systems of the world. Rivers draining into the ocean. Rivers draining into lakes. Groups of lakes; their extent and peculiarities. Waterfalls and rapids.
10. Circulation of water in the interior of the earth. Course of rain water through rock. Issue of this water in springs. Temperature of springs. Mineral and gaseous contents of springs. Quantity of water issuing from springs, and of solid matter deposited by them. Variation of springs.
11. Conveyance of water by clouds, and its deposit as rain. Distribution of rain. Proportion of rainfall that runs over the earth's surface. Formation of snow. Circumstances under which it is formed and deposited. Snow line; its position in different parts of the world. Passage of snow into ice. Glaciers; their ancient and modern history. Glacial action; its nature and results. Icebergs—how and where formed; their influence. Hail; its formation and effects.
12. The atmosphere. Composition and properties of air. Its uses and effects on light. Its extent. Its colour. Effect of heat on the atmosphere. Waves of sound. Nature of wind. Permanent winds. Periodical winds. Circulation of the air by upper currents from the equator to the poles, and corresponding return currents from the poles to the equator. Distribution of winds in both hemispheres. Special local winds and their cause. Various kinds of storm winds. Nature of cyclonic storms. Phenomena connected with such storms.
13. Phenomena of weather and climate. Causes that produce or modify climate. Lines connecting places having equal annual, equal summer, or equal winter heat. Value of such lines as indicating climate. Conditions that affect weather and climate. Cycles of weather and climate. Changes of climate, and the cause of such changes.
14. Volcanic phenomena. General action of volcanoes. The conditions of a volcanic eruption. The parts of the world that contain volcanoes. Number of volcanoes in the different groups; their position and history of the eruptions. Inactive or extinct volcanoes. Pseudo-volcanoes and phenomena connected with decaying volcanic activity. Geysers, solfataras, and mud volcanoes. Volcanic action under the sea. Periods and cycles of volcanic disturbance. Earthquakes. Zones of earthquake disturbance. Relation of earthquakes to volcanoes. Periodicity of earthquakes.
15. Distribution of life on the earth. Persistence of life. Origin of species. Modification of species. Grouping of plants. Representative and typical species. Advance of certain forms of plant life. Migration and migratory powers of plants. Floras of different countries. Distribution of floras. Faunas, their distribution. Groups of characteristic animals. Migration and migratory instincts. Limitation of these instincts. Distribution of plants and animals in time. Extinction and replacement of species.

16. Distribution of man. Date of introduction of the human family. Early existence of certain typical groups. Mode in which these groups differ anatomically among each other. Mixed races. Migrating and settled races, and their mutual influence. Natural and artificial limits of extension of the various races. Influence of man on external nature.

Sound knowledge of the main facts and an acquaintance with the mode of action of natural causes to produce results will be expected from the more advanced students.

Examination for Honours.

For this examination it will be expected that the candidates shall not only be familiar with the ordinary facts and inferences, but that they should be able to give a tolerably complete outline in their own language of groups of facts and their mutual bearing, together with explanations of natural phenomena on which the principles of physical geography depend.

Sound knowledge acquired, not only from text books, but from a thoughtful examination of the views of various authors or from a personal study of the facts and phenomena will be expected from those who seek an honour certificate, and very clear and definite information on the subjects attempted will be indispensable.

For elementary instruction in physical geography there are several recognised text books. It unfortunately happens that in some of these the facts are incorrectly stated, and teachers employing them must be careful to make the requisite alterations in their course of teaching.

The following book, which has been recently published, is recommended :—

* *The World we Live in*, by D. T. Ansted.
(London, Allen & Co., 1868.)

Of somewhat older date are :—

Text Book of Physical Geography, by Dr. Page, 12mo., 2*s*.
(Edinburgh, Blackwood, 1863.)

Outlines of Physical Geography, by E. Hughes, 12mo., 3*s*. 6*d*.
(London, Longman, new ed., 1866.)

Elementary Class Book of Physical Geography, by W. Hughes, 12mo., 1*s*. (London, Philip, 1866.)

The following will be found suggestive to teachers, but are hardly sufficiently complete to be available for students :—

Earth and Man; a Lecture by A. Guyot, *translated* by C. C. Felton, 12mo., 2*s*. (London, Bentley, 1865.)

Physical Geography for Schools, by M. F. Maury, 12mo., 2*s*. 6*d*.
(London, Longman, 1864.)

There is at present only one general work that comprises the whole subject of physical geography as required for the examination in the advanced course :—

Physical Geography, by D. T. Ansted, 8vo., 12*s*.
(London, Allen, 3rd ed., 1868.)

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* This work contains a glossary of technical terms.

In addition to the following, many other works in special departments of the science will be found useful to the advanced student and to the candidate in honours:—

Physical Geography of the Sea, by M. F. Maury, 8vo., 5*s*. (London, Low, 12th ed., 1866.)
Man and Nature, by G. P. Marsh, 8vo., 14*s*. (London, Low, 1864.)
Principles of Geology, by Sir C. Lyell, 2 vols. 8vo. (London, Murray, 1866.)
Principles of Seismology, by R. Mallet, 2 vols. 8vo., 63*s*. (London, Chapman and Hall, 1862.)

It is most desirable that this subject should be taught and studied with good physical maps at hand. For the elementary course is recommended—

Small Atlas, by Hughes.

For the advanced student:—
Physical School Atlas, by Johnston.
Larger Physical Atlas, by Johnston.

APPENDIX C.

TABLES showing the NUMBER of STUDENTS in each SCIENCE SCHOOL or CLASS, and the SUBJECTS taught.

TABLE I.

LIST of SCIENCE SCHOOLS, giving the NUMBER of STUDENTS returned as under INSTRUCTION in MAY 1867 and MAY 1868, and the NUMBER of PRIZES and MEDALS obtained in MAY 1867 and MAY 1868.

Schools established since May 1868 are in Italics. Schools marked with an * are Navigation Schools not examined in May 1868.

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.	
					1867.	1868.			1867.	1868.	1867.	1868.
			ENGLAND.									
Abingdon	British School	Harper, Rev. E. T.	Davis, J. G.	Gubb, E. J.; Gubb, Mrs.	30	46	16	..	8	14	..	..
Accrington	Mechanics' Institution	Ingram, J.	Ratcliffe, W.	Isherwood, T.; Brown, T.	21	29	8	..	10	18	..	..
Alderley Edge	Reading-room and Library	Consterdine, Rev. J.	Wilkins, A.	Dale, J.	14	18	4	..	8	6	..	..
Almondbury	Grammar School	Brigg, J. T.	Dyson, E.	Easther, Rev. A.; Jarmain, G.	28	26	..	2	..	2	..	..
Alnwick	Mechanics' Institution	Granville, Rev. C.	Robertson, A.	Muxlow, T.; McVail, D. C.	..	28	28	..	..	..	..	..
Altrincham and Bowdon.	*Literary Institution*	*Ransome, A.*	*Davis, S. B.*	*Monks, P.*	..	..	..	..	..	..	..	..
Andover	Grammar School	Clarke, T. P.	Footner, R.	Marriott, J. T.	45	39	..	6	3	6	..	..
Ashby-de-la-Zouch	Mutual Improvement Society.	Green, Rev. T. S.	Dalby, J.	Gibson, G. H.	37	19	..	18	2	8	..	..
Ashton-under-Lyne	Mechanics' Institution	Mason, H.	Hay, G.	Jones, T.	20	29	9	..	8	12	..	..
Aston	*Christ Church M. I. S. Rooms.*	*Lord, Rev. I.*	*Windsor, J.*	*Bulpitt, W. T.*	..	..	..	..	..	..	..	..
Bacup	Mechanics' Institution	Aitken, J.	Pilling, J.	Shore, T. W.; Tomkins, E.	51	42	..	9	7	27	..	..
Bacup	*Wesleyan Day Schools*	*Dawson, J.*	*Lord, W. H.*	*Holland, J.*	..	..	..	..	..	..	..	..
Balham	*Working Men's Institute*	*Large, Rev. W. I. A.*	*Loat, J. H.*	*Jones, T.; Pritchard, Z.*	..	..	..	..	..	..	..	..
Banbury	British School	Samuelson, B., M.P.	Hewett, G. A.	Beale, J. H.; Owen, A.	66	48	..	18	21	8	..	1 B.
Banbury	*Mechanics' Institute*	*Cobb, F. R.*	*Wilson, A.*	*French, A.*	..	..	..	..	..	..	..	..
Banstead	*School-room*	*Glyn, P. C.*	*Buckle, Rev. E. V.*	*Knibbs, H.*	..	..	..	..	..	..	..	..
Barnard Castle	*Mechanics' Institute*	*Brown, Rev. F.*	*Monkhouse, J.*	*Witter, J. A.; Taylor, R.*	..	..	..	..	..	..	..	..

Barnsley	Market Street School	Allen, T.	Gratton, J.	Brears, W.	17	18	1	..	..	1	..	..
Barnstaple	*Literary and Scientific Institution.*	*Miller, J. M.*	*Knill, W.*	*Dunston, J. J.* *Maunder, S. G.*	..	..	..	..	..	..	..	..
Batley	*Mechanics' Institution*	*Jubb, J.*	*Hick, W. H.*	*Osborne, J.*	..	..	..	..	..	..	..	..
Beccles	*Leman Schoolroom*	*Garnham, W. W.*	*Whiting, Rev. R.*	*Boyce, H.*	..	..	..	..	..	..	..	..
Bedford	*St. Mary's Parochial School*	*Gray, T. T.*	*Kaye, Rev. A.*	*Glover, A. W.*	..	..	..	..	..	..	..	..
Hingley	Mechanics' Institution	Irwine, Rev. A. P.	Todd, T.	Sovers, G.	..	17	17	..	..	8	..	..
Birkenhead	*School of Art*	*Taylor, J.*	*Hinde, W. E.*	*Bentley, J.*	..	..	..	..	..	..	..	..
Birmingham	B. and Midland Institute	Mathews, W., jun.	Smith, E.	Woodward, C. J. Bulpitt, W. T. Hinds, W. Hinds, J.	135	152	17	..	20	49	..	1 B.
"	School of Art	Cope, C. R.	Laundy, E.	Raimbach, D. W. Causer, W. G.	55	75	20	..	28	33	1 S.	1 B.
"	Clarendon Chambers	Manton, H.	Southall, A.	Smith, D. Turner, J. Davis, J. Smith, A. F.	..	11	11	..	..	8	..	..
"	Bloomsbury Institution	Milward, Rev. H. C.	Atkins, J.	Smith, D. Smith, A. F. Bulpitt, W. T. Griffin, J. R. Walton, W.	..	80	80	..	..	36	..	..
Birmingham	*Graham Street Institution*	*Vince, Rev. C.*	*Jannings, J. W.*	*Smith, D.* *Walton, W.*	..	..	..	..	..	..	..	..
"	*Church of the Sav. School*	*Myers, Rev. E.*	*Hemming, W. H.*	*Embrey, G., junr.*	..	..	..	..	..	..	..	..
"	*St. George's School*	*Thornton, Rev. S.*	*Smith, G.*	*Bulpitt, W. T.*	..	..	..	..	..	..	..	..
"	*St. Paul's School*	*Burges, Rev. R. B.*	*Langford, J. A.*	*Embrey, G., junr.*	..	..	..	..	..	..	..	..
"	*12, Ann Street*	*Manton, H.*	*Hart, J.*	*Burton, C.*	..	..	..	..	..	..	..	..
"	*St. Mary's School*	*Barrett, Rev. J. C.*	*Jones, J.*	*Bulpitt, W. T.*	..	..	..	..	..	..	..	..
"	*St. Mark's School*	*Thwaites, Rev. H. G.*	*White, W.*	*Buckley, H. C.*	..	..	..	..	..	..	..	..
"	*St. Clement's School*	*Milward, Rev. H. C.*	*Hawkes, B.*		..	..	..	..	..	..	..	..
"	*Deritend Working Men's Association.*	*Solomon, H.*	*Greening, W. H.*	*Bulpitt, W. T.*	..	..	..	..	..	..	..	..
"	*New Jerusalem Schools*	*Tonks, S.*	*Osborne, J.*	*Jones, G. F.*	..	..	..	..	..	..	..	..
"	*Middle Class School*	*Rolason, W.*	*Payton, H.*	*Causer, W. G.* *Hall, S.*	..	..	..	..	..	..	..	..
"	*Bishop Ryder's School*	*Yorke, Rev. G. M.*	*Burges, Rev. J. H.*	*Paterson, C.* *Thorneloe, J.*	..	..	..	..	..	..	..	..
Birstall	Mechanics' Institution	Heald, Rev. W. M.	Priestley, J. W.	Patchett, I.	..	26	26	..	..	22	..	..
Blackburn	Wesleyan School	Beads, J.	Parkinson, G.	Isherwood, T. Spriggs, C.	13	9	..	4	2	4	..	..
Blackburn	*Church Institute*	*Woodhouse, Rev. C.*	*Elwell, Rev. H.*	*Sayle, J.*	..	..	..	..	..	..	..	..
Blackley	*Assembly Room*	*Langton, W.*	*Schofield, J.*	*Hurst, W.*	..	..	..	..	..	..	..	..
Blyth	*Waterloo School*	*Greenwell, Rev. W.*	*Rees, W.*	*Rowden, W. T.*	..	..	..	..	..	..	..	..

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.	
					1867.	1868.			1867.	1868.	1867.	1868.
Bodmin	Literary Institution	Stokes, H. S.	Phillipps, J.	Downing, S.	47	31	..	16	13	16	..	..
Bolton	Science and Art School	Powell, Rev. Canon	Doman, Rev. J. G.	Collins, J.; Spriggs, C.	168	193	25	..	27	37	..	..
"	Mechanics' Institution	Harwood, R.	Barrow, I.	Spriggs, C.	79	67	..	12	27	16	..	1 B.
Boston	*National School*	*Blenkin, Rev. G. B.*	*Lowe, Rev. G.*	*Gane, W.*	..	..	..	..	..	..	..	..
"	*School of Art*	" "	"	*Howard, V.*	..	..	..	..	..	..	..	..
Bow, North	*Old Ford School-room*	*Schnadhont, Rev. E.*	*Smith, E.*	*Duff, C.*; *Saunders, J.*	..	..	..	..	..	..	..	..
Bradford	*Mechanics' Institute*	*Law, J.*	*Holbrey, J.*	*Severs, G.*	..	..	..	..	..	..	..	..
Breage	Wheal Vor, Sithney, and Cross.	Pridmore, Rev E.	Argall, W.	Collins, J. H.; Kitto, B.; Henty, G. M.; Tyack, W.; Francis, H.	12	23	11	..	11	17	..	2 B.
Brigstock	*Farming Woods School*	*Attenborough, J.*	*Bradshaw, W. P.*	*Garner, S.*; *Dumas, J.*	..	..	..	..	..	..	..	..
Bristol	Trade School	Moseley, Rev. Canon	Wilkson, J.	Coomber, T.; Plant, E. C.; Welsh, J.; Morgan, W.	145	145	..	..	97	106	2 G. 1 S. 1 B.	1 G. 1 B.
Bristol	*Young Men's Christian Association.*	*Cornall, Rev. R.*	*Pengelly, T. H.*	*Boone, F. T.*	..	..	..	..	..	..	..	..
Brixworth	*Boys' School-room*	*Watkins, Rev. C. F.*	*Harper, F. L.*	*Graves, J. J.*	..	..	..	..	..	..	..	..
Bromsgrove	Literary and Mechanics' Institution.	Murray, Rev. G. W.	Gibson, C. W.	Dodd, W.	48	26	..	22	7	7	..	..
Buckingham	*National School*	*Morris, Rev. W. F.*	*Waters, H.*	*Heel, E.*	..	..	..	..	..	..	..	..
Burnley	Literary Institution	Parker, Rev. A. T.	Briggs, B. W.	Shore, T. W.	55	58	3	..	14	14	..	..
"	Carlton Road School	Ashworth, D.	Graham, J.	Grant, J.	66	61	..	8	..	6	..	..
"	Mechanics' Institution	Kay - Shuttle worth, Sir J. P., Bart.	Sutherland, J.	Shore, T. W.; Thompson, J.	46	48	..	..	5	12	..	..
"	Grammar School	" "	"	Shore, T. W.; Wilkinson, T. T.	50	40	..	10	..		..	..
Bury	Athenæum	Hildyard, Rev. C. F.	Probert, T. W.	Spriggs, C.	72	79	7	..	27	25	1 S.	..

Chester	*Lower Grammar School*	*Maclean, Rev. H.*	*De Mowbray, Rev. J.*	*Thomas, R.*	..	..	..	..	..	..	..	..
Camborne	Basset Street	Chappel, Rev. W. P.	Reynolds, J. F.	Provis, T. B.	31	24	..	7	8	5	..	..
Canning Town	Holy Trinity School	Meyrick, Rev. M.	Peacock, W. H.	Shipman C. ; Downar, W. A.	..	12	12	..	..	5	..	..
Cardiff	Free Library	Tomlinson, J., jun.	Price, P.	Bush, J. ; Thomas, G.	48	63	21	..	24	27	..	..
Carharrack	*Literary Institution*	*Tucker, E. B.*	*Hawke, E. H.*	*Collins, J. H.*	..	..	..	..	..	..	..	..
Chatham	St. Mary's School	Hills, V.	Wilkins, T.	Byatt, H. ; Farlie, J. L.	..	40	40	..	..	26	..	..
"	St. Mark's, New Brompton	Neville, H. J. W.	Bridger, J.	Byatt, H. ; Stanton, G.	..	27	27	..	..	19	..	..
Cheltenham	School of Science, Clarence Parade.	Skillicorne, W. N.	Moore, H. J.	Ewens, F. T. ; James, H. A. ; Litting, G.	146	212	66	..	40	32	8 G.	1 G.
Cheltenham	*Training College*	*Skillicorne, W. N.*	*Moore, H. J.*	*James, H.*	..	..	..	..	..	..	..	..
"	*Whitworth School*	*Lumb, R. K.*	*Dixon, R. J.*	*Davis, W. S.* ; *Sergeant, L.* ; *Davis, T. H.*	..	..	..	..	..	..	..	..
Chester	Mechanics' Institution	Frost, M.	Deacle, Rev. E. L.	Craister, W.	25	30	5	..	2	8	..	..
Chorley	St. George's National School	Barton, R. H.	Stock, J.	Brown, T.	20	20	..	..	7	7	..	..
Church	*National School*	*Birchall, Rev. J.*	*McKenzie, T. S.*	*Sutcliffe, G.*	..	..	..	..	..	..	..	..
Colne	*Grammar School*	*England, T. T.*	*Philips, T.*	*Brown, T.*	..	..	..	..	..	..	..	..
Compstall	Athenæum	Andrew, C.	Fernley, J.	Hurst, W.	..	27	27	..	..	20	..	..
Coventry	*St. Peter's National School*	*Odell, J.*	*Tabberer, Rev. G.*	*Bates, J.*	..	..	..	..	..	..	..	..
Cradley	School-room	Thompson, Rev. J. H.	Gregg, Rev. T. H.	Hodgetts, C. B.	..	6	6	..	..	2	..	..
Creaton, Great	*National School*	*Wood, J.*	*Crow, Rev. E.*	*Meredith, J.*	..	..	..	..	..	..	..	..
Crewe	Mechanics' Institution	Ramsbottom, J.	Jackson, J. A.	Craister, W.	15	44	29	..	7	20	..	..
Croydon	Literary Institution	Carpenter, A.	Lanchester, H. T.	Jones, T. ; Duckett, W.	29	38	9	..	9	13	..	..
Culham	Training College	Pott, Rev. A.	Causton, Rev. F. J.	Ridgway, Rev. J. ; Herbert, Rev. A.	..	27	27	..	..	8	..	..
Darlington	Mechanics' Institution	Pease, H.	Watson, T. W.	Heys, A. ; Weatherill, R.	12	13	1	..	1	6	..	..
Dartford	National School	Bowlby, Rev. H. B.	Perry, A.	Busbridge, W. ; Dance, W.	..	36	36	..	..	27	..	..
Dartmouth	Mutual Improvement Society.	Newman, A.	Rees, W. H.	Hamlyn, E.	..	26	26	..	..	6	..	..
Darwen	Mechanics' Institution	Blamire, Rev. W. H.	Neville, E.	Isherwood, T.	29	14	..	15	2	8	..	..
Daventry	*Grammar School*	*Collyns, Rev. J. M.*	*Marriott, T. H.*	*Rigby, J.*	..	..	..	..	..	..	..	..
Denton and Haughton.	Mechanics' Institution	Nicol, Rev. W.	Collins, John	Gee, W. ; Booth, I.	10	33	23	..	1	12	..	..
Deptford	St. Paul's Boys' School	Malcolmson, Rev. J.	Marchant T. W.	Busbridge, W. ; Hopper, T. ; Ellercamp, H.	40	21	..	19	24	27	..	..

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1867.	Number of Individuals under Instruction. 1868.	Increase.	Decrease.	Number of Prizes. 1867.	Number of Prizes. 1868.	Number of Medals. 1867.	Number of Medals. 1868.
Deptford	*Mechanics' Institution*	*Avery, C.*	*Noak, W.*	*Jones, T.* *Theaker, G.* *Child, T.*	..	..	..	..	..	..	..	..
Derby	Grammar School	Forman, T. B.	Bowring, C.	Greaves, C. A.	10	12	2	..	2	..	..	..
Devonport	*Mechanics' Institution*	*Peek, W.*	*Chapple, S.*	*Balkwill, F. P.*	..	..	..	..	..	..	..	..
Dewsbury	Mechanics' Institution	Day, E.	Warburton, J.	Shaw, J.	..	17	17	..	..	1	..	..
Doncaster	*The Guildhall*	*Vaughan, Rev. C. J.*	*Bishop, T. H.*	*Constable, J.*	..	..	..	..	..	..	..	..
Droylsden	Educational Institution	Hadwen, J.	Hadfield, J.	Hurst, W. Riley, J. Baguley, M.	37	58	21	..	22	23	..	..
Dudley	*Mechanics' Institution*	*Harper, R.*	*Hollier, E.*	*Green, F.* *Williams, J.* *Causer, W. G.*	..	..	..	..	..	..	..	..
Dukinfield	*Blue Coat School*	*Wainwright, H.*	*Brettell, T.*	*Williams, J.*	..	..	..	..	..	..	..	..
"	*Old Chapel Sunday School*	*Marshall, W.*	*Cartwright, J.*	*Jones, T.*	..	..	..	..	..	..	..	..
"	*Moravian Boys' School*	*Sutcliffe, Rev. C. E.*	*Knott, C. J.*	*Jones, T.*	..	..	..	..	..	..	..	..
Durham	Training College	Henderson, W.	Earle, W. E.	Ashwell, Rev. A. B. Powley, W. Howard, C. C.	..	29	29	..	..	14	..	..
Eagley	Institute	Greg, A.	Marson, C.	Pinnington, W.	..	31	31	..	..	5	..	..
Earlestown	Mutual Improvement Society.	Whitley, Rev. J.	Shaw, C.	Stott, H., senr. Burchall, C.	..	17	17	..	..	5	..	..
Earls Barton	*British School*	*Gaudern, J.*	*Sheffield, D.*	*Webb, J.*	..	..	..	..	..	..	..	..
Eastington	National School	Peters, Rev. T.	Hooper, C. H.	Wilcox, E. Wilcox, E., junr.	11	15	4	..	6	3	..	..
Eastwood	Mechanics' Institution	Plumptre, Rev. H.	Weston, W.	Fisher, H.	20	13	..	7	4	6	..	..
Elland	Science School, Southgate	Farrar, J.	Kaye, U.	Jarmain, G. Stopford, W. H.	20	22	2	..	13	11	..	..
Eton	*Parochial Institution*	*Jackson, Rev. W. W.*	*Moyle, Rev. V. H.*	*Moir, D.*	..	..	..	..	..	..	..	..
Exeter	Albert Memorial Museum	Head, R. T.	Tucker, J. T.	D'Urban, W. S. M. Perkins, F. P. Sheppard, W.	37	32	..	5	15	11	..	..
Failsworth	Mechanics' Institution	Wright, R.	Brierley, J.	Stott, H., senr. Stott, H., junr.	..	8	8	..	..	1	..	..

Farnworth	*Grammar School*	*Taylor, Rev. W. H.*	*Bowden, T.*	*Spriggs, C.*	..	..	..	..	..	..	..	..
Farnworth and Kersley.	*Mechanics' Institution*	*Barnes, A.*	*Thornley, P.*	*Monks, P.*	..	..	..	..	..	..	..	..
Flore	*Endowed School House*	*Johnson, Rev. F. P.*	*Poole, D.*	*Rigby, J.*	..	..	..	..	..	..	..	..
Friezland	*Christ Church School*	*Whitehead, J. H.*	*Venables, Rev. G.*	*Kershaw, J.*	..	..	..	..	..	..	..	..
Gateshead	National School	Prest, Ven. E.	Arnold, Rev. R. S.	Wheatley, M. J.; Russell, Rev. C. D.; Brodie, A.	..	39	39	..	..	13	..	..
Glossop	*Working Men's Institute*	*Stafford, J.*	*Bradbury, E.*	*Jones, T.*	..	..	..	..	..	..	..	..
Gloucester	Blue-coat School	Washbourn, B.	Fowler, Rev. H.	Jeffery, Walter	46	44	..	3	4	38	..	..
"	10, Eastgate Street	"	"	Davis, W. S.	..	34	34	..	..		..	..
Gomersal	*Mechanics' Institution*	*Crowther, W.*	*Kellett, J.*	*Patchett, I.*	..	..	..	..	..	..	..	..
Grantham	*National School*	*Astlee, W.*	*Maddison, Rev. G.*	*Cookman, A.*	..	..	..	..	..	..	..	..
Greenwich	Girls' National School	Miller, Rev. J. C.	Howarth, W.	Wright, H. E.; Gough, W. G.	..	20	20	..	..	11	..	..
Halifax	Working Men's College	Akroyd, E., M.P.	Gibb, G.	Jarmain, G.; Stopford, W. H.	17	35	18	..	3	7	..	1 G. 1 B.
Halliwell	*Dean Mills*	*Callender, W. R., jun.*	*Taylor, W.*	*Spriggs, C.*	..	..	..	..	..	..	..	..
Hampton	*Commercial Schoo*	*Burrow, Rev. J.*	*Raw, D. B.*	*Bickerton, A. W.*	..	..	..	..	..	..	..	..
Haslingden	Institute	Thompson, R.	Binns, J.	Shore, T. W.	19	16	..	1	4	3	..	..
Helston	*Grammar School*	*Penberthy, F.*	*Hosking, J. H.*	*Tyacke, W.*	..	..	..	..	..	..	..	..
Hetton	*Colliery Schools*	*Wood, L.*	*Widdowfield, F.*	*Rowden, W. T.; Meek, J.*	..	..	..	..	..	..	..	..
Heywood	Mechanics' Institution	Storry, Rev. R.	Fairbrother, G.	Crawshaw, J.; Duerr, G.	32	44	12	..	23	8	..	..
Hingham	*National School*	*Darby, Rev. M. B.*	*Hardinge, Rev. J. R.*	*Wilson, W. E. H.*	..	..	..	..	..	..	..	..
Hollinwood	Working Men's Institute	Collinge, J.	Wilde, J.	Haslam, W.	..	31	31	..	..	9	..	..
Holywell Green	*Mechanics' Institution*	*Shaw, S.*	*Shaw, S. W.*	*Shaw, J.*	..	..	..	..	..	..	..	..
Hopwood	*Methodist Free Church School.*	*Cheetham, C.*	*Fairbrother, G.*	*Duerr, G.*	..	..	..	..	..	..	..	..
Huddersfield	Mechanics' Institution	Freeman, J.	Bate, J.	Jarmain, G.; Kershaw, T.	16	23	7	..	3	9	..	..
Hull	Nautical School	Whitaker, T.	Wilson, E. S.	Scaping, Z.	73	80	7	..	96	50	3 G. 2 S. 4 B.	2 G. 1 S. 1 B.
Huntingdon	Walden's School	Ward, W.	Vesey, Rev. F. G.	Pascoe, J.	20	16	..	4	7	3	..	..
Hurst	*Mechanics' Institution*	*Rowley, A. B.*	*Pleasants, J.*	*Stott, H.*	..	..	..	..	..	..	..	..
Hyde	Mechanics' Institute	Hibbert, E.	Lawton, T.	Fallows, J. T.; Parnell, G.; Taylor, T.	60	41	..	19	21	17	..	7
Kendal	*Post Office Yard Room*	*Whitwell, J., M.P.*	*Braithwaite, C. L.*	*Prosser, W.*	..	..	..	..	..	..	..	..

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1867.	1868.	Increase.	Decrease.	Number of Prizes. 1867.	1868.	Number of Medals. 1867.	1868.
Kersley	*British School*	*Fletcher, J.*	*Gee, S.*	*Collins, J.*	..	..	..	..	..	..	..	..
Kettering	National School	Lindsay, Rev. H.	Eldred, G.	Sturgess, W.	21	52	31	..	16	23	..	..
Kettering	*British School-room*	*Toller, W.*	*Mursell, Rev. J.*	*Brooks, W. W.*	..	..	..	..	..	..	..	..
Kidderminster	*Mutual Improvement Society*	*Boyle, Rev. G. D.*	*Fortescue, Rev. H.*	*Thompson, G.*	..	..	..	..	..	..	..	..
Kilburn	*St. Mary's School*	*Kennion, Rev. A.*	*Willis, W.*	*Kehde, H.*	..	..	..	..	..	..	..	..
Kingsbridge	Town Hall	Davis, Rev. J. U.	Thomas, W. J.	Head, A.	12	17	5	..	7	..	..	..
Kinver	Mill Room	Hodgson, Rev. J.	Bolton, W. H.	Packer, M. W.	34	25	..	9	8	5	..	..
Lamport	*Endowed School*	*Isham, C. E.*	*Isham, R.*	*Graves, J. J.*	..	..	..	..	..	..	..	..
Lancaster	Mechanics' Institution	Howitt, T.	Moore, J. D.	Prosser, W.	53	48	..	5	7	9	..	..
Langdale	*Endowed National School*	*Coward, Rev. J.*	*Bousfield, J., jun.*	*Sutton, W. A.*	..	..	..	..	..	..	..	..
Leeds	Mechanics' Institute	Holmes, J.	Dayson, J. O.	Ward, G. Hick, T. Todd, W. Horsman, T.	39	47	8	..	5	25	..	1 B
Leeds	*St. Peter's National School*	*Woodford, Rev. J. R.*	*Wood, Rev. F. J.*	*Jefferson, S.*	..	..	..	..	..	..	..	..
„	*St. Peter's National School (Schoolmaster's Class).*	*Fairbairn, Sir A.*	*Sales, H. H.*	*Jarmain, G.*	..	..	..	..	..	..	..	..
„	*Young Men's Christian Association.*	*Barran, J.*	*Smith, W. H.*	*Jefferson, S.*	..	..	..	..	..	..	..	..
„	*Working Men's Institute*	*Lupton, D.*	*Lupton, D., jun.*	„	..	..	..	..	..	..	..	..
Lees	Parish Church School	Booth, J. E.	Whittaker, Rev. R.	Kershaw, T., jun.	..	33	33	..	..	11	..	..
Leicester	St. Martin's School	Vaughan, Rev. D. J.	Jones, H. S.	Atkins, E.	49	53	4	..	5	16	..	..
„	St. Margaret's School	Jones, Rev. T.	Pertwee, Rev. A.	Padmore, S.	5	5	..	..	..	..	..	..
Leighton Buzzard	*Mutual Improvement Society*	*Harris, T.*	*Page, W. S.*	*Lewis, E. W.*	..	..	..	..	..	..	..	..
Lewes	*School of Art*	*Godlee, B.*	*De Putron, Rev. P.*	*Fisher, A.*	..	..	..	..	..	..	..	..
Lewisham	*St. Mary's National School*	*Legge, Rev. H.*	*Sowerby, Rev. W. J.*	*Wright, H. E.* *Gough, W. G.* *Churchill, C.*	..	..	..	..	..	..	..	..
Limehouse	St. Anne's National School	Jones, Rev. E. R.	Wiggins, F.	Farncomb, E.	..	24	24	..	..	2	..	..
Lincoln	*Training School*	*Jarvis, G. K.*	*Blenkin, Rev. F. B.*	*Meers, Miss J. P.*	..	..	..	..	..	..	..	..
Liverpool	Free Library and College	Graves, S. R., M.P.	Gregson, S. L.	Carter, W.	68	60	..	8	13	18	..	..

"	Institute	Holt, F. H.	Sharp, C.	Ewart, E. B.; Adair, S.	90	107	17	..	15	38	..	..
Llanelly	Copper Works School	Nevill, C. W.	Morgan, R.	Jones, J.; Jones, A.	40	73	24	..	11	28	..	..
LONDON:												
Battersea	St. John's College	MacCarthy, Rev. J.	Dugard, F.	*Faunthorpe, Rev. J. P.*; *Roberts, G.*	..	80	80	..	..	98	..	1 G. 1 S.
"	Sir Walter St. John's School	Ince, Rev. E. C.	Hardy, T. B.	Martin, J.	68	58	..	10	45	..	2 B.	..
Battersea	*Christ Church Schools*	*Ince, Rev. E. C.*	*Foster, G. W.*	*Brown, H.*; *Bickerton, A. W.*	..	..	..	..	..	..	..	..
"	*Working Men's Club*	*Griffith, Rev. T. C.*	*Tyrer, T.*	*Weightman, F. J.*	..	..	..	..	..	..	..	..
Bermondsey	Christ Church Schools	Martin, Rev. R. M.	Logg, J. W. H.	Jones, T.; Child, T.	..	22	22	..	..	4	..	..
Bermondsey	*Working Men's Institute*	*Cox, W. H.*	*Fawcitt, R.*	*Hudson, W.*	..	..	..	..	..	..	..	..
Bethnal Green	Birkbeck School	Rogers, Rev. W.	Rünts, G.	Pike, R. W.; Heney, J.	130	106	..	24	15	33	1 B.	..
"	National School	Hansard, Rev. S.	Ewing, Rev. A.	Simpson, B.; Angel, H.; Farncomb, E.	52	115	63	..	15	13	1 G.	..
Brixton Hill	Working Men's Club	Longridge, J. A.	Gibbons, G.	Jones, T.; Bradbury, A. A.	..	9	9	..	..	8	..	..
Chancery Lane	*Birkbeck Literary and Scientific Institution*	*Campbell, Hon. D.*	*Knott, J. W.*	*Chaloner, G.*; *Dyte, D. H.*	..	..	..	..	..	..	..	..
Chelsea	St. Mark's College	Batty, Rev. W. E.	Quilter, J. S.	Eastburn, Rev. C. F.; Dawe, Rev. C. S.; Lawson, W.; Harrison, W. T.	124	48	..	76	70	62	1 G. 1 S. 1 B.	..
"	Arthur Street	Dilke, Sir C. W., Bart.	Demans, Rev. R.	Bickerton, A. W.; Davies, S. W.	..	158	158	..	..	46	..	1 S. 1 B.
"	Royal Military Asylum	Muller, Col. E. A.	Langmead, Rev. G. W.	Reynolds, W. J.	..	11	11	..	..	11	..	..
*Dock Street	Sailors' Home	Maude, Capt. the Hon. F.	Webb, Capt. W. H.	Newton, J.	256	398	72	..	..	..	..	..
Goswell Road	*St. Barnabas' National School*	*Ward, Rev. H.*	*Millington, Rev. W.*	*Conning, J.*; *Furniss, J. S.*	..	..	..	..	..	..	..	..
Gray's Inn Rd.	*St. Jude's School*	*Andrews, Rev. J. M.*	*Wooldridge, J. W.*	*Busbridge, W.*	..	..	..	..	..	..	..	..
Great Ormond St.	Working Men's College	Maurice, Rev. F. D.	Rawlins, H. E.	Grugeon, A.	18	15	..	3	4	2	1 S.	..
Hackney	St. Thomas' Square School	Daniell, Rev. R. S.	Reynolds, A. W.	Howard, J.; Bond, G.	..	48	48	..	..	12	..	..
Islington, Lower	Public School	Fleming, Rev. W.	Wheatley, H. J.	Howard, J.; Angel, H.	109	145	36	..	35	38	1 B.	..
Islington	*St. Silas' National School*	*Wilkinson, Rev. J.*	*Huse, W.*	*Hepburn, R.*; *Swanson, W.*	..	..	..	..	..	..	..	..

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1867.	1868.	Increase.	Decrease.	Number of Prizes. 1867.	1868.	Number of Medals. 1867.	1868.
London—*cont.*												
Kennington	*St. John's Middle Class Sch.*	*Reed, F.*	*Neville, J.*	*Schenk, R.*	..	..	..	..	..	..	..	..
Kentish Town	*Gospel Oak School*	*Lee, Rev. C.*	*Slanes, H. T.*	*Bond, G.*	..	..	..	..	..	..	..	..
Lambeth	National School	Lingham, J.	Jones, Walter W.	Jones, T. Hernaman, J. Browne, L. Jones, E. S. L. Duckett, W. Brittle, J. R. Heller, T. E.	39	155	116	..	18	13	..	1 S. 1 B.
Lambeth	*School of Art*	*Gregory, Rev. R.*	*Herbert, Rev. G. W.*	*Sparkes, J.* *Jennings, J.* *Schenk, R.*	..	..	..	..	..	..	..	..
Leadenhall St.	City of London College	Mackenzie, Rev. C.	Hansen, H. W.	Gibsone, Rev. B. W. Hawker, G.	34	30	..	4	..	..	..	..
Long Acre	*Whitefield School-room*	*Scatliff, J. P.*	*Fraser, A. A.*	*Duffy, F. P.*	..	..	..	..	..	..	..	..
Marylebone	Central Boys' School	Eyre, Rev. C. J. P.	Goody, Rev. C. J.	Jones, T. McCarthy, W. W. Ricks, G.	..	48	48	..	..	2	..	..
Marylebone	*Quebec Club*	*Fremantle, Rev. W.*	*Davison, R. W.*	*Dorrell, C. F.* *Dorrell, H. B.*	..	..	..	..	..	..	..	..
Nine Elms	*Lecture Room*	*Mather, Rev. W. M.*	*Sellar, F.*	*Bickerton, A. W.* *Davis, S. W.*	..	..	..	..	..	..	..	..
Notting Hill	*Shaftesbury Hall*	*Gell, Rev. P.*	*Winton, W.*	*Jones, T.* *Catley, W.* *Swanson, W.*	..	..	..	..	..	..	..	..
Paddington	Greville House	Merivale, J. L.	Deans, C.	Jones, T. Duckett, W. Bray, G.	..	31	31	..	..	10	..	..
Peckham	Upper and Middle Schools	Gray, R. A.	Hutchison, T.	Jones, A. Brower, W. H. Oxer, T. Clarke, G. W.	348	362	14	..	22	30	..	..
Poplar	*All Saints' National School*	*Nowell, Rev. T. W.*	*Fairbairne, W.*	*Swise, H.* *Gase, R. H. J.*	..	..	..	..	..	..	..	..

Regent Street	Royal Polytechnic Institution	Mackenzie, Rev. C.	Cousens, J.	Downar, G. F. Hardy, J.	47	46	..	1	20	19	..	1 G. 1 S. 3 B.
South London	Working Men's College	Huxley, Prof.	Rossiter, W.	Jones, T. Hande, G. J. Bithell, B.	..	..	..	..	..	..	..	..
Southwark	Borough Road Training College.	Owen, H.	Bourne, S.	Curtis, J. C. Smith, A. F. Barkby, E.	..	60	60	..	..	28	..	..
Southwark	Boys' Model School	Owen, H.	Bourne, S.	Langton, J.	..	..	..	..	..	..	..	..
„	Swan Street Boys' Nat. Sch.	Moulton, Rev. D. A.	Bayles, W. J.	Parry, P.	..	..	..	..	..	..	..	..
„	Working Men's Club	Desborough, Rev. H.	Tayler, S. S.	Hudson, W.	..	..	..	..	..	..	..	..
Stepney	Red Coat School	Charrington, F.	Scott, W.	Parry, P.	..	..	..	..	..	..	..	..
Upper Berkeley St.	Hamden Gurney Schools	Holland, Rev. F. J.	Birley, Rev. E. H.	Browne, L.	..	..	..	..	..	..	..	..
Vauxhall	Baptist Chapel School-room	Lawrence, J. C., M.P.	Hearson, Rev. G.	Busbridge, W. Newman, G.	..	..	..	..	..	..	..	..
„	Wandsworth Road	Shepherd, Rev. C. P.	Grimsdick, C.	Parry, P.	..	..	..	..	..	..	..	..
Wandsworth	Royal Patriotic Fund Boys' School	Lindsay, Maj.-Gen.	Mugford, W. H.	Bickerton, A. W. White, H.	..	..	..	..	..	..	..	..
Waterloo Road	St. John's Schools	Johnston, Rev. J. A.	Quaif, W.	Busbridge, W. Norman, H. Thompson, R.	..	30	30	..	..	33	..	..
Westminster	Wesleyan Training College	Hall, T. F.	Olver, Rev. G. W.	Sugden, W. Langler, J. R. Mansford, C.	..	29	29	..	..	28	..	..
Westminster	St. James's School	Dickson, Rev. G.	Giveen, Rev. R. L.	Busbridge, W. Whitehouse, H. J.	..	..	..	..	..	..	..	..
Luddenden Foot	Day School-room	Whitworth, W.	Hillman, Rev. S. D.	Tattersall, A.	..	..	..	..	..	..	..	..
Macclesfield	Modern Free School	Wardle, T.	Brooker, J.	Jackson, J.	36	43	7	..	..	..	..	..
Maldon	Mechanics' Institution	Horwood, Rev. E. R.	Crick, G. E.	Hollinshed, T. M. Potter, J. W.	..	12	12	..	..	9	..	..
Manchester	Mechanics' Institution	Neill, R.	Jones, E. L.	Angell, J. Gee, W. Mellor, J. Tomkins, E.	239	200	..	30	58	64	1 B.	1 G. 1 S. 2 B.
„	Roby Society's School	Callender, R. W., jun.	Wilkinson, E.	Stott, H., jun. Almgill, T.	31	39	8	..	6	9	..	..
„	Corporation Street	Booth, G.	Larmuth, G. H.	Lightbown, J. H.	36	41	5	..	2	13	..	..
„	St. George's National School	Lindsay, Rev. T.	Gregory, J.	Kay, W.	12	12	..	..	..	1	..	..
„	Hulme Working Men's Institution	Booth, W.	Letch, G. A.	Richardson, J. Richardson, H. Jones, T.	46	31	..	15	8	12	..	..
Masham	Grammar School	Hedley, Rev. T.	Fisher, J.	Crawley, S.	..	..	..	..	..	..	..	..
Melton Mowbray	Church School-room	Colles, Rev. W. M.	Willcox, W.	Greasley, J.	..	3	3	..	..	..	..	..

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1867.	1868.	Increase.	Decrease.	Number of Prizes. 1867.	1868.	Number of Medals. 1867.	1868.
Middlesborough	St. John's Schools	Smith, Rev. A. C.	Blair, Rev. G. A.	Stead, W.	6	11	5	..	..	8	..	..
Middleton	National School	Bates, Rev. E.	Ward, Rev. C. B.	Wheeler, G. H.	22	22	..	..	13	17	..	1 B.
Millwall	*Presbyterian School*	*Whitmore, Rev. C. J.*	*Auld, J.*	*Farncomb, E.*	..	..	..	..	..	..	..	..
Modbury	The Institution	Green, Rev. G. C.	English, Rev. A.	Pady, W. J.	..	10	10	..	..	1	..	..
Monkwearmouth	*Colliery School*	*Stobart, W.*	*Walter, J. E.*	*Rowden, W. T.*	..	..	..	..	..	..	..	..
Mossley	Mechanics' Institution	Jones, Geo. A.	Jackson, T.	Kershaw, T.	..	23	23	..	..	2	..	..
Nailsworth	*National School-room*	*Stokes, T.*	*Thomas, Rev. E. T.*	*Smith, P. L.*	..	..	..	..	..	..	..	..
Nelson-in-Marsden	Lomeshaye Schools	Ecroyd, W.	Waddington, J.	Clement, L.	27	36	9	..	21	23	1 B.	..
Newark	Mechanics' Institution	Godfrey, T. S.	Lammin, H.	Webster, J. H. Turnbull, J.	..	34	34	..	..	3	..	..
Newcastle-on-Tyne	*Elswick Works Mechanics and Literary Institute*	*Maughan, Rev. W.*	*Allan, G.*	*Rowden, W. T.*	..	..	..	..	..	..	..	..
New Mills	News Room, Market Street	Taylor, J.	Godward, E.	Hurst, W.	..	30	30	..	..	7	..	..
Newton	*School-room*	*Dwarris, Rev. B. E.*	*Johnson, Rev. A.*	*Ingram, J. S.*	..	..	..	..	..	..	..	..
Newton Heath	All Saints' National School	Hutchinson, Rev. W.	Hudson, T.	Parnell, G.	..	18	18	..	..	5	..	..
Newton Heath	*Dixon Street*	*Wright, R.*	*Brierley, J.*	*Stott, H., sen.* *Stott, H., jun.*	..	..	..	..	..	..	..	..
Northampton	Museum and Town Hall	Compton, Rev. Lord A.	Hensman, J. B.	Lees, C. Leney, Miss	..	115	115	..	..	30	..	1 B.
North Ormesby	Church Institute	Pennyman, J. S.	Sharrock, Rev. W. R.	Weatherill, R.	7	7	..	..	4	4	..	..
Nottingham	Mechanics' Institution	Morse, Rev. F.	Thurlow, R.	Taylor, A. C. Truman, E. B. Wilson, E. Major, H. Andrews, H.	35	61	26	..	4	17	..	..
Oldbury	National School	Taylor, Rev. W. T.	Gill, J.	Spencer, P.	..	61	61	..	..	12	..	..
,,	Messrs. Chance's Institution	Chance, H.	Chance, A. M.	Horton, F. C.	..	14	14	..	..	..	..	..
Oldham	Science and Art Schools	Platt, J., M.P.	Bailey, T.	Phythian, J. P. Philip, J. Walters, C.	100	80	..	20	67	42	3 B.	..
,,	Glodwick Mutual Improvement Society	Harrop, E.	Green, J.	Kershaw, T., jun. Platt, W.	30	30	..	..	17	14	..	..
,,	Analytical Literary Institute	Yates, J.	Hall, R.	Taylor, W. Haslam, W.	14	44	30	..	11	16	..	..

	Parish Church School	Bamford, J.	Walters, Rev. W.		10	33	14	..	..	..	..	..
Openshaw	Ashbury Carriage Works	Airey, Rev. J. P.	Ashbury, T., jun.	Tomkins, E.	..	..	..	..	..	..	..	..
"	Wesleyan Day School	Tyler, Rev. G. S.	Kay, J.	Hurst, W.	..	..	..	..	..	..	..	..
Ouston Ferry	Wesleyan School	Johnson, Rev. W. D.	Sharp, R.	Fletcher, T. M.	..	..	..	..	..	..	..	..
Oxford	Town Hall	Spiers, E. T.	Alden, E. C.	Gubb, H. J.	..	..	..	..	..	..	..	..
Padiham	National School	Fox, Rev. J. H.	Harland, T. D.	Shore, T. W.	18	10	..	8	2	..	..	..
Patricroft	Mechanics' Institution	Wilson, R.	Hewitt, J.	Tomkins, E.	..	27	27	..	..	17	..	1 S. 1 B.
Pavenham	Church of Eng. School-room	Tucker, J.	Ram, Rev. S. J.	Glover, A. W.	..	..	..	..	..	..	..	..
Pembroke Dock	Mechanics' Institution	Cocks, J.	Sinnette, G. M.	Fitze, W. J.	..	..	..	..	..	..	..	..
Pendeen	National School	Aitken, Rev. R.	Bennett, J.	Oats, F.	..	..	..	..	..	..	..	..
Pendleton	Mechanics' Institution	Ashworth, J.	Clay, J., jun.	Beever, J.	17	20	3	..	7	4	..	..
Pendleton	Pendleton Club	Armitage, E., jun.	Armitage, B.	Stott, H., jun.	..	..	..	..	..	..	..	..
Penzance	School of Science and Art	Mathews, W. D.	Rodd, W. H.	Geoffroi, H. M.	..	24	24	..	..	4	..	..
Peterborough	St. Peter's College	Walker, T., M.D.	Saviger, J.	Girling, R. G. S. Tomlinson, J.	..	..	..	..	..	..	..	..
Plumstead	Burrage Road School	McAllister, Rev. J. A.	Hammond, J.	Shipman, C. Farlie, C. J. Candler, G. Downar, G. F.	62	57	..	5	67	58	..	..
Plymouth	Courtenay Street	Bate, C. S.	Cawse, J. H. M.	Rickard, G. J. Evers, H. Hingston, C. A. Rider, A. J. Merrifield, J. Balkwill, F. P.	154	163	9	..	63	81	1 S. 1.B.	1G. 3 S. 4 B.
"	Buckwell Street	Risk, Rev. J. E.	Widlake, T. H.	Hearder, J. N.	18	18	..	5	3	6	..	..
"	Navigation School	Hill, R.	Cuming, W. B.	Merrifield, J.	..	344	344	..	..	..	..	..
Plymouth	Charles National School	Greaves, Rev. H. A.	Cuddeford, T.	Evers, H. Foster, J. B.	..	..	..	..	..	..	..	..
Portland	The Grove School	Clifton, G.	Hill, Rev. A.	Moore, E. W.	15	30	15	..	3	2	..	..
Preston	Institution, Avenham	Myres, M.	Newsham, W.	Cope, J. G. Spriggs, C. Walley, T. J.	37	57	20	..	9	30	..	1 S. 1B.
Ramsbottom	Public Institute	Butcher, Rev. J. H.	Barlow, R.	Jones, T.	..	17	17	..	..	5	..	..
Rawmarsh	- - - - -	Ashcroft, Rev. T.	Simmonite, H.	Brears, W.	..	..	..	..	..	..	..	..
Rawtenstall	Mechanics' Institution	Whitehead, J. B.	Wardleworth, W.	Tomkins, E.	..	55	55	..	..	33	..	..
Redditch	Literary and Scientific Institution.	Bartleet, R. S.	Sparrow, S.	Bryant, J. E. Hall, E.	..	..	..	..	..	..	..	..
Redruth	The Institution	Manley, Rev. W. L.	Grylls, W. M.	Phillips, W. Terrill, W., jun. Collins, J. H.	..	10	10	..	1	2	..	..
Riddings	Mutual Improvement Association	Walsh, Rev. T. H.	Wood, S. A.	Casson, J. H. Briffault, F.	..	..	..	..	..	..	..	..
Rochdale	British Schools	Whitaker, C.	Belmont, E.	Tomkins, E. Duerr, G.	..	47	47	..	..	18	..	..

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1867.	Number of Individuals under Instruction. 1868.	Increase.	Decrease.	Number of Prizes. 1867.	Number of Prizes. 1868.	Number of Medals. 1867.	Number of Medals. 1868.
Royton	St. Paul's National School	Whittaker, R.	Hill, Rev. R.	Taylor, W.	..	54	54	..	..	8	..	..
Rumworth	*Sunnyside Institution*	*Barhall, Rev. W.*	*Ingham, J.*	*Monks, P.*	..	..	..	..	..	..	..	..
Saddleworth	*Mechanics' Institution*	*Shaw, G.*	*Platt, S.*	*Kaye, W.*	..	..	..	..	..	..	..	..
St. Helen's	Commercial School	Mocatta, Rev. W. A.	Walthew, Rev. J. H.	Bournes, T.	19	23	4	..	1	4	..	..
St. Just	The Institution	Boyns, R.	Boyns, R.	Oats, F.	25	14	..	11	7	..	1 G.	..
Salford	Working Men's College	Davis, T.	Plant, J.	Richardson, J.; Law, E.; Holl, J.; Monks, P.; Shorrocks, J. H.	44	53	9	..	6	11	..	..
Salford	*The Egerton Schools*	*Moore, Rev. J.*	*Unsworth, E.*	*Maybury, C. W.*	..	..	..	..	..	..	..	..
Saltaire	*Literary Institute*	*Kelly, Rev. W.*	*Morrell, G.*	*Severs, G.*	..	..	..	..	..	..	..	..
Saltley	Training College	Smythe, Rev. P. M.	Smith, Rev. F.	Haworth, Rev. T. J.; Bulpitt, W. T.	..	20	20	..	..	37	..	..
Scarborough	*Mechanics' Institute*	*Woodall, J. W.*	*Delamere, N. H.*	*Beevor, J.*; *Yewdall, J. H.*; *Potter, F.*	..	..	..	..	..	..	..	..
Shaw	*National School*	*Milne, H. T.*	*Bartleet, Rev. S. E.*	*Taylor, W.*; *Newton, I.*	..	..	..	..	..	..	..	..
Sheffield	*Christian and Educational Institute*	*Vickridge, Rev. E.*	*Wardlow, C.*	*Allen, A. H.*; *Turner, R.*	..	..	..	..	..	..	..	..
"	*St. Paul's School*	*Sale, Rev. T.*	*Buckle, A.*	*Harrison, G.*	..	..	..	..	..	..	..	..
"	*St. George's School*	" "	"	*Sanderson, N.*	..	..	..	..	..	..	..	..
"	*Church Institute*	" "	"	"; *Sutton, J.*	..	..	..	..	..	..	..	..
Slough	Mechanics' Institution	Simpson, Rev. R. J.	Ward, W. H.	Dorrell, J.; Dorrell, C. F.; Dorrell, H. B.	63	23	..	40	4	4	..	..
Southampton	The Hartley Institution	Mayes, E.	Le Feuvre, J. H.	Bond, F. T.; Rankin, F.; Edmonds, F.	..	40	40	..	..	1	..	..
Southminster	National School	Page, W., jun.	Berkeley, Rev. G. C.	Fleming, J.	..	1	21	..	..	3	..	..
Southport	*Athenæum*	*Boothroyd, S.*	*Craven, R.*	*Spriggs, C.*	..	..	..	..	..	..	..	..
South Shields	*Jarrow Works Mechanics' Institution*	*Stevenson, J. C., M.P.*	*Noble, J.*	*Rowden, W. T.*; *Lungi*; *Hill*; *Smoult*	..	..	..	..	..	..	..	..

Southwick	*Working Men's Reading Room.*	*Penney, R. H.*	*Frampton J. W.*	*Pullen, M.*	..	..	..	..	..	..	..	..
Stainland	*Independent School*	*Watts, Rev. L. L.*	*Whiteley, F. W.*	*Welby, R.*	..	..	..	..	..	..	..	..
Stalybridge	*Mechanics' Institution*	*Marsland, J.*	*Wood, J.*	*Hurst, W.*	..	..	..	..	..	..	..	..
Stockport	Mechanics' Institution	Heginbotham, H.	Stockdale, R.	Gee, W. Davonport, T. Davies, G. W. Goodwin, J. W.	39	45	6	..	15	19	..	..
"	Sunday School Improvement Society	Wilkinson, S. W.	Hill, J.	Rathbone, T. H. Davies, G. W.	..	18	18	..	..	5	..	..
Stonehouse	*The Institute*	*White, Rev. W. F.*	*Holland, Rev. P. E.*	*Smith, P. L.*	..	..	..	..	..	..	..	..
Stourbridge	*Grammar School*	*Freer, R. L.*	*Marten, E. B.*	*Welch, Rev. W. J. J.*	..	..	..	..	..	..	..	..
Stratford	Working Men's Hall	Scott, Rev. T.	Mackey, G.	Swiss, H. Smith, H. H. Swiss, W. G.	..	58	58	..	..	37	..	..
Stroud	The Institute	Dickinson, S.	Philp, G. T. Gardner, H. F.	Vick, W. Okey, J. Smith, P. L.	63	29	..	34	12	11	1 G.	..
Swansea	Royal Institution of South Wales and Oxford Street National School	Wilson, C. T.	Wilks, A. P.	Cole, F. Molison, A Scheffer, Dr.	..	45	45	..	..	4	..	..
Tavistock	British School	Straker, E.	Luxton, R.	Moffatt, W.	..	50	50	..	..	22	..	..
"	Gulworthy School	Mitchell, Rev. J. B.	Phillips, W.	Evers, H. Gaud, J. H. Gaud, J. W.	..	34	34	..	..	9	..	1 B.
Tavistock	*National School*	*Tancock, Rev. O. J.*	*Monk, H. E.*	*Rider, A. J.* *Merrifield, J.* *Loam, J.*	..	..	..	..	..	..	..	..
"	*St. Mary Tavy National School.*	*Buller, Rev. A.*	*Lemon, Rev. C.*	*Moffatt, W.*	..	..	..	..	..	..	..	..
Tebworth	Wesleyan School	Seccombe, Rev. W.	Gurney, N.	Mackrell, I.	12	13	1	..	1	8	..	..
Thorne	Brookes' Grammar School	Jannings, Rev. G.	Lister, W.	Constable, J.	..	17	17	..	..	5	..	..
Thorpe	*St. Matthew's Boys' School*	*Owen, Rev. J. S.*	*Caley, J. W.*	*Marsh, W. H.*	..	..	..	..	..	..	..	..
Toddington	*National School*	*Cooper, W. C.*	*Clegg, Rev. J.*	*Billingham, E.*	..	..	..	..	..	..	..	..
Torquay	School of Science and Art	Sheppard, A. G. R.	Luxmoore, C. N.	Viccars, T.	36	63	27	..	13	28	..	1 B.
Towcester	*National Schools*	*Hesketh, Sir T. G. F., Bart., M.P.*	*Lightfoot, Rev. R. P.*	*Jones, J. C.*	..	..	..	..	..	..	..	..
Truro	*British School*	*Tweedy, R.*	*Clyma, G.*	*Snell, J.*	..	..	..	..	..	..	..	..
"	*Royal Institution*	*Barham, C.*	*Mayne, J. O.*	*Collins, J. H.*	..	..	..	..	..	..	..	..
Turton	*Chapel Town Institution*	*Spencer, Rev. T. O.*	*Haworth, T.*	*Stott, H.*	..	..	..	..	..	..	..	..
Tyldesley	*Mechanics' Institution*	*Green, G.*	*Lomas, W.*	*Stott, H., jun.*	..	..	..	..	..	..	..	..
Ulverstone	Temperance Hall	Fell, J.	Sykes, J. S.	Eckersley, H.	..	18	18	..	..	2	..	..
Wakefield	*Holy Trinity Young Men's Society.*	*Madden, Rev. W. M.*	*Dixon, J. H.*	*Patchett, I.*	..	..	..	..	..	..	..	..

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.	
					1867.	1868.			1867.	1868.	1867.	1868.
Wakefield	*Mechanics' Institution (Schoolmaster's Class).*	*Holdsworth, S.*	*Dixon, J. H.*	*Jarmain, G.*	..	..	..	..	..	..	..	..
Warrington	Museum and Free Library	Beamont, W.	Webster, G. M.	Bournes, T.	..	102	102	..	..	6	..	..
Weedon	*Girls' School*	*Winter, Rev. J. S.*	*Williamson, Rev. A.*	*Norman, S. A.*	..	..	..	..	..	..	..	..
Wellingborough	Lower Grammar School	Broughton, Rev. H.	Roxby, Rev. H. M.	Winterton, W. Sturgess, W.	..	30	30	..	..	12	..	..
Werneth	Mechanics' Institution	Milnes, T.	Chadderton, F. H.	Mellor, J.	..	33	33	..	..	14	..	..
West Bromwich	*St. Peter's School*	*Massey, Rev. C.*	*Jesson, Rev. H.*	*Hill, S. T.*	..	..	..	..	..	..	..	..
Westbury-on-Trym	*Girls' National School*	*Bright, Rev. J. H.*	*Pease, T.*	*Plant, E. C.* *Plant, A. U.*	..	..	..	..	..	..	..	..
West Gorton	*St. Mark's National School*	*Connell, Rev. A.*	*Jackson, T.*	*Ward, R. P.*	..	..	..	..	..	..	..	..
Whaleybridge	Mechanics' Institution	Kirk, J.	Colles, A. H.	Stott, H.	..	19	19	..	..	2	..	..
Whitworth	*Literary Institution*	*Kay, E. G.*	*Lord, J.*	*Sutcliffe, G. W.*	..	..	..	..	..	..	..	..
Wigan	Town Hall	Fergie, Rev. T. F.	Peace, M. W.	Betley, R. Percy, C. M.	23	71	48	..	9	17	..	1 B.
Wilsden	*Mechanics' Institution*	*Clapham, P.*	*Watmuff, W. G.*	*Severs, G.*	..	..	..	..	..	..	..	..
Windsor	*Mechanics' Institution*	*Gooch, Sir D., Bart., M.P.*	*Rawlins, Rev. F. J.*	*Dorrell, J. W.* *Dorrell, H. B.*	..	..	..	..	..	..	..	..
Wisbech	Working Men's Institute	Scott, Rev. J.	Balding, A.	Miller, S. H.	..	24	24	..	..	7	..	..
Woking	*St. John's School*	*Wilks, Rev. T. C.*	*M'Cormack, R.*	*Goffin, R.* *Goffin, J.*	..	..	..	..	..	..	..	..
Wollaston	*Church of England Schools*	*Gilbanks, Rev. G.*	*Boden, G.*	*Packer, M. W.*	..	..	..	..	..	..	..	..
Wolverhampton	Athenæum	Iles, Rev. J. H.	Langley, J. N.	Packer, M. W.	12	12	..	..	1	13	..	..
"	St. Peter's School	" "	" "	Horton, F. C. Booth, H. C.	..	38	38	..	..		..	..
"	St. Luke's School	Parry, Rev. J.	Wilks, M.	Breakwell, W.	..	8	8	..	..	1	..	..
"	St. John's School	Hampton, Rev. H.	-	Board, G.	..	4	4	..	..	..	..	..
Wolverton	Science and Art Institution	Mumford, A. L.	Meadley, J.	Harnett, Rev. F. W. Davison, W. Nichols, T. Goyer, A.	60	65	5	..	35	18	..	..
Woodville	*National School*	*Wilmshurst, Rev. A.*	*Betterton, H. T.*	*Binns, A.*	.	..	..	..	..	..	..	..
Woolwich	Royal Arsenal Science Classes	Oram, W. E. S.	Keeble, W. D.	Jones, T. Noble, J. Clarke, J. J. Duckett, W. Bristo, J. E.	60	144	84	..	48	55	..	1 B.

„	National School	Brown, Rev. H.	Harrison, Rev. F. S.	Farlie, C. J.; Swiss, H.	58	40	..	18	40	33	..	..
„	St. Thomas' School	Robertson, Capt., R.N.	Norman, J. H.	Busbridge, W.; Hopper, T.; Hardy, J.; Downar, G. F.; Charlesworth, T.; Ellis, A.	65	95	30	..	57	72	1 G. 1 B.	1 B.
„	Presbyterian District School	Thompson, Rev. W.	Ronald, H.	Jones, T.; Browne, L.; Lomas, C.; Redding, R. J.; Courtman, R. S.; Browne, F.	..	98	98	..	..	8	..	..
„	St. Michael's School	Baker, Rev. H. R.	Ruegg, L. J.	Byatt, H.; Farlie, J. L.; Stanton, G.	..	15	15	..	..	13	..	..
Woolwich	*Rectory Place School*	*Balgarnie, Rev. R.*	*Fairbrother, W.*	*Hepburn, R.*	..	..	..	..	..	..	..	..
„	*13, Dundas Terrace*	*Oram, W. E. S.*	*Keeble, W. D.*	*Jones, E. S. L.*	..	..	..	..	..	..	..	..
Worcester	Guildhall	Webb, W.	Day, H.	Ewens, F. T.	..	71	71	..	..	19	..	..
Worcester	*School of Art*	*Webb, W.*	*Day, H.*	*Plant, E. C.*	..	..	..	..	..	..	..	..
„	*Workman's Hall*	*Wood, J.*	*Walter, W. H.*	Spencer, J.; Gwinnell, W. F.	..	..	..	..	..	..	..	..
Yarmouth, Great	Navigation School	Fellows, H.	Bracey, J.	Stockton, W.	112	81	..	81	1	1	..	..
York	The Institute	Palmer, Rev. H. V.	Hall, R.	Proctor, W.; Hewison, Rev. G. H.; Robinson, R.	120	80	..	40	3	6	1	..
York	*Blue Coat School*	*Richardson, W.*	*Ford, J.*	*Robinson, E.*	..	..	..	..	..	..	..	..
„	*Training College*	*Hay, Rev. Canon*	*Bresher, Rev. M. R.*	*Rowe, Rev. G.*	..	..	..	..	..	..	..	..

SCOTLAND.

Aberdeen	Mechanics' Institute	Matthews, J.	Sinclair, J.	Beveridge, R.; Maver, D.	69	61	..	8	6	3	..	..
„	*Navigation School	Forbes, D.	Kellas, J. F.	Jones, J. R.	254	317	63	..	..	..	..	..
Aboyne	*Parish School-room*	*McKenzie, Rev. J.*	*Coutts, J.*	*Summerfield, E.*	..	..	..	..	..	..	..	..
Alexandria		*Ewing, G. Orr*	*Greenlees, W.*	*Tatlock, R. K.; McIntyre, R.; Andrew, D.*	..	..	..	..	..	..	..	..
Banchory	Lady Burnett's School	Hutchison, Rev. G.	Stewart, J.	Ritchie, G.	..	13	13	..	..	6	..	..
Banton	*Banton School*	*McPherson, J.*	*Walker, J.*	*Forbes, A.*	..	..	..	..	..	..	..	..
Beith	New Street School	Muir, W.	Kerr, J.	Cook, W.	..	7	7	..	..	..	..	..
Brechin	*School-room*	*Scott, D.*	*Craig, J.*	*Cameron, J.*	..	..	..	..	..	..	..	..
Corsock	Girls' School	Sturrock, Rev. G.	Currie, R.	Macomish, M.	26	13	..	13	3	4	..	..

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1867.	1868.	Increase.	Decrease.	Number of Prizes. 1867.	1868.	Number of Medals. 1867.	1868.
Cults	*School-room*	*Paul, Rev. W.*	*Taylor, J.*	*Summerfield, E.*	..	..	..	..	..	..	..	..
Cupar	*Madras Academy*	*Hood, R.*	*Taylor, W. A.*	*Reid, W.* *Bonnar, G. L.*	..	..	..	..	..	..	..	..
Dalry	*Blair Iron Works School*	*Biggart, J.*	*Loudon, A.*	*Stevenson, J.*	..	..	..	..	..	..	..	..
Dumbarton	Burgh Academy	McNeil, T.	Babtie, J.	Dickie, H.	..	12	12	..	..	..	..	..
Dundee	High School	Thoms, W.	Cumming, A. W.	Kennedy, J.	57	70	13	..	14	6	..	1 G. 1 B.
Edinburgh	*Free Church Training College.*	*Chambers, W. (Lord Provost).*	*Archer, Prof*	*Lees, W.* *Kennedy, W.*	..	..	..	..	..	..	..	..
"	*Watt Institution*	" "	"	*Pryde, J.* *Lees, W.* *Macadam, S.*	..	..	..	..	..	..	..	..
Glasgow	Secular School	McClelland, J.	Cunliff, R. S.	Mayer, J. Mayer, E. Lochore, J. Stone, W.	163	80	..	83	52	22	..	..
" †	Andersonian University	Young, J.	Martin, G.	Herschel, A. S. Buchanan, G. Penny, F. Hennedy, R. Laing, A.	827	730	..	97	23	33	..	1 B.
"	Mechanics' Institution	Neilson, W. M.	Anderson, J.	Moffat, R. C.	..	950	950	..	..	7	..	1 B.
Glasgow	*Established Church Normal School.*	*Craik, Rev. J.*	*Snodgrass, G. W.*	*Dixon, E. M.*	..	..	..	..	..	..	..	..
Inverness	School of Science and Art	Simpson, A.	Galloway, G.	Bain, R. L. Robertson, G. W.	20	27	7	..	8	3	..	..
Kilmarnock	Foulds Street	Dickie, J.	Stewart, J.	Stevenson, J. Neil, J.	48	76	28	..	12	14	..	..
Kilmarnock	*New Academy*	*Webster, Rev. A.*	*Mackay, J.*	*Gunnyon, W.*	..	..	..	..	..	..	..	..
Kirkwall	Grammar School	Robertson, J.	Heddle, P. S.	Watson, Rev. J. Burns, R.	..	10	10	..	..	..	..	..
Leith	Navigation School	Watt, J.	Thomson, Rev. J.	Bolam, J.	200	228	28	..	5	..	..	..
Newhills	Stoneywood School-room	Smith, J.	Black, G.	Williamson, W. A.	..	17	17	..	5	..	..	..
Perth	*School of Art*	*Barclay, H.*	*M'Neill, J.*	*Hutton, D. C.*	..	..	..	..	..	..	..	..
Rutherglen	*Free Church School*	*Murray, D.*	*Bowers, J.*	*Stone, W.*	..	..	..	..	..	..	..	..
Tarbat	Parochial School	Campbell, Rev. G.	Mackie, J.	Fraser, Rev. D.	..	16	16	..	..	1	..	..

IRELAND.

Anahilt	*Endowed Free School*	*Erwin, Rev. R. S.*	*Moorhead, Rev. R.*	*Clements, A.*	..	..	..	..	..	..	..	..
Antrim	Male National School Main Street National School	Viscount Massareene	Taggart, W. J.	Savage, H. Spears, R.	45	66	25	..	6	14	..	..
Athlone	St. Mary's Parochial School	Handcock, Hon. R.	Berry, Rev. E. F.	James, M. H.	28	37	0	..	7	16	..	2 B.
"	Ranelagh School	"	"	Cavanagh, J. McIntosh, W. T.	..	32	32	..	..	35	..	..
Bagenalstown	School-room	Morrin, Rev. P.	Brennan, Rev. H.	Fitzgerald, E.	..	39	39	..	..	7	..	..
Bailieboro'	Model School	Dalton, G. T.	Simpson, A. J.	Doherty, J. J.	86	84	..	2	34	38	..	1 G. 1 S.
Ballybay	*National School*	*Burdett, Rev. H.*	*Breakey, W. A.*	*McClean, W.*	..	..	..	..	..	..	..	..
Ballyblack	*School-room*	*Parke, R. C.*	*Mitchell, Rev. W.*	*Gebby, R.*	..	..	..	..	..	..	..	..
Ballycarry	National School	Dalway, M. R.	Smiley, A.	M'Giffin, R. M'Connell, F.	7	24	17	..	2	7	..	..
Ballykinlar	*National School*	*O'Hara, Rev. J.*	*Smith, P.*	*Skeffington, J. B.*	..	..	..	..	..	..	..	..
Ballymena	Model School	Rowan, Rev. R. W.	Wilson, D. M.	Shannon, A. F.	28	18	..	10	5	4	..	..
Ballymena	*Guy's National School*	*Patrick, J.*	*Killen, J.*	*Alexander, J.*	..	..	..	..	..	..	..	..
Ballymoney	*Town Hall*	*M'Elderry, T.*	*M'Elroy, S. C.*	*Elliott, T.*	..	..	..	..	..	..	..	..
Ballynahinch	*Town Hall*	*Anketell, W. R.*	*Davis, Rev. J.*	*Priestley, J. R.*	..	..	..	..	..	..	..	..
"	*National School*	*Crawford, J.*	*Bradley, Rev. W.*	*Goodman, J.*	..	..	..	..	..	..	..	..
Ballywalter	*Park School*	*Wilson, Rev. H.*	*Gibson, J.*	*M'Kimm, S.*	..	..	..	..	..	..	..	..
Ballywilly	National School	Irwin, Rev. J.	MacShane, Rev. C.	Nugent, F. Lee, H.	..	19	19	..	..	..	..	..
Banbridge	Scarva Street N.S.	Rutherford, Rev. J.	Anderson, Rev. R.	Gillespie, J.	28	64	36	..	4	15	..	..
Bangor	*Endowed School*	*M'Cullagh, Rev. J.*	*Patteson, Rev. W.*	*O'Reilly, J. C.* *Scott, S. M.*	..	..	..	..	..	..	..	..
Belfast	Fisherwick Place School	Browne, W.	Shepherd, W.	Cleeland, R. Elliott, T.	28	83	55	..	14	18	1 S.	1 B.
"	St. George's School			MacMillen, W.	..	25	25	..	..	8	..	..
"	Milford Street National School.	Morrison, Rev. A.	"	Collins, T.	..	15	35	..	..	4	..	..
"	May Street National School	" "	"	Cullen, W. Carroll, J.	..	27	27	..	..	8	..	..
Belfast	*Northumberland Street National School.*	*Browne, W.*	*Shepherd, W.*	*Small, H.*	..	..	..	..	..	..	..	..
"	*Union Place National Sch.*	"	"	*Anderson, J.*	..	..	..	..	..	..	..	..
"	*70, Albert Bridge Road*	"	"	*Mangnall, J.*	..	..	..	..	..	..	..	..
"	*Conway Street National School.*	*McCausland, S.*	"	*Kerrigan, J.*	..	..	..	..	..	..	..	..

† Out of the 1,680 Students at these two Schools, only 117 applied for examination in 1868.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1867.	Number of Individuals under Instruction. 1868.	Increase.	Decrease.	Number of Prizes. 1867.	Number of Prizes. 1868.	Number of Medals. 1867.	Number of Medals. 1868.
Belfast -	Model School -	Alexander, Capt.	Molloy, J.	Doran, G.; Wren, E.; Smeeth, B.	177	141	..	36	27	40	1 B.	..
"	Academy Street, No. 1 National School.	M'Causland, S.	Hanna, Rev. H.	Barbour, S.	20	13	..	7	..	7	..	..
Belfast -	*Academy Street, No. 2 National School.*	*M'Causland, S.*	*Hanna, Rev. H.*	*Campbell, D.*	..	..	..	..	..	..	..	..
"	*Smithfield National School*	"	"	*Robinson, J.*	..	..	..	..	..	..	..	..
"	*Glentilt Place*	*Cotter, Rev. W.*	*Goldsmith, O.*	*Robertson, W.*	..	..	..	..	..	..	..	..
"	*Brown Street National School.*	*Lytle, J.*	*Johnston, Rev. W.*	*Donaldson, T.*	..	..	..	..	..	..	..	..
"	*Nelson Street National Sch.*	*Knox, Rev. R.*	*Hannah, S.*	*Bingham, H.*	..	..	..	..	..	..	..	..
"	*People's Literary Institute*	*Lanyon, Sir C.*	*Maitland, F. A.*	*Whitford, W.; Perry, J.; Drennan, A.*	..	..	..	..	..	..	..	..
Bessbrook	School-house -	Lett, Rev. H. W.	Wonfor, W. J.	Lyons, M.	..	21	21	..	..	3	..	..
Braidwater	National Schools	Kidd, A.	Lynch, Rev. J.	Black, R.; McCormick, J.; O'Neill, A.	..	15	15	..	..	3	..	..
Brookfield	*Agricultural School*	*Richardson, J. J.*	*Swann, T.*	*Pedlow, G.*	..	..	..	..	..	..	..	..
Broughshane	*National School*	*Davison, A.*	*Patman, E.*	*Alexander, J.*	..	..	..	..	..	..	..	..
Caledon	*School-house* -	*Prentice, H. B.*	*Armstrong, Rev. W. B.*	*Brownlee, T.*	..	..	..	..	..	..	..	..
Carlow	Christian Schools	Tynan, M. F.	Hade, A.	Mayne, A. J.	18	21	3	..	..	1	..	..
Carrickfergus	Model School -	Birnie, T. M.	Pasley, D.	Stevenson, J. M.	54	42	..	12	23	16	..	..
Carrowdore -	*National School*	*Crommelin, S. A. H. D.*	*Gilmore, Rev. A. G.*	*Clements, W. T.*	..	..	..	..	..	..	..	..
Castlederg	*Edward's School, &c.*	*Edwards, Rev. E.*	*Crockett, Rev. J.*	*M'Granahan, W.*	..	..	..	..	..	..	..	..
Castlefin	*National School*	*Smith, C.*	*Elliott, T.*	*O'Flanagan, T.*	..	..	..	..	..	..	..	..
Clohanbeg	*National School*	*O'Gorman, W. S.*	*Quinlivan, Rev. M.*	*Hunt, T.*	..	..	..	..	..	..	..	..
Clonakilty	*National School*	*Lacey, Rev. J.*	*Mulcahy, Rev. J.*	*Pendergast, P.*	..	..	..	..	..	..	..	..
Cloncore	*National School*	*Clements, Rev. W.*	*M'Varry, Rev. T.*	*Lee, H.; Nugent, F.*	..	..	..	..	..	..	..	..
Coleraine	Model School -	Bruce, Sir H. H., Bart., M.P.	Bole, W.	Brealand, J.	..	60	60	..	..	14	..	..

Comber	Smyth's National School	Rogers, Rev. J.	Withers, R.	Watt, W. D.; Leetch, J.; Browne, W. J.; Cleland, J. M.	80	96	10	..	20	15	..	..
"	No. 1 National School											
Comber	*Lisbarnet National School*											
Cooraclare	National School	O'Gorman, W. S.	Quinlivan, Rev. M.	M'Dermott, C.	..	40	40	..	..	14	..	..
Cork	District Model School	Macnamara, Rev. A. D.	M'Cord, Rev. G. M.	Linehan, P.; Latchford, G. D.; Latchford, Mrs. G. D.; Finnegan, B. M.	46	65	19	..	14	34	..	1 B.
Cork	*Carmichael School*	*M'Ostrich, A.*	*Magill, Rev. W.*	*Robinson, J.*	..	..	..	..	..	..	..	..
Cormeen	*National School*	*Bailey, Rev. W. R.*	*Fleming, T.*	*M'Clean, W.*	..	..	..	..	..	..	..	..
Crebilly	*National School*	*Kidd, A.*	*Lynch, Rev J.*	*M'Cormick, J.*	..	..	..	..	..	..	..	..
Dartreyhouse	*National School*	*Earl of Dartrey*	*Stewart, J.*	*MacMillen, R.*	..	..	..	..	..	..	..	..
Derrylin	*National School*	*Benison, J. J.*	*Winslow, H. M.*	*Doogan, P.*	..	..	..	..	..	..	..	..
Donaghadee	*National School-house*	*M'Minn, A.*	*M'Aulay, Rev. J.*	*Scott, S. M.; O'Reilly, J. C.*	..	..	..	..	..	..	..	..
Donegal	*National School*	*Mulvany, Rev. R.*	*Hamilton, A.*	*Patterson, W.*	..	..	..	..	..	..	..	..
Donoughmore	*Presbyterian Lecture-room*	*Quinn, Rev. J. C.*	*Elliott, Rev. J.*	*Williams, T. M.*	..	..	..	..	..	..	..	..
Downpatrick	Young Men's Christ. Assoc.	Davis, W.	Pilson, C.	Bell, J.	..	20	20	..	..	10	..	..
Downpatrick	*John Street National School*	*Pilson, C.*	*Clarke, J.*	*Fitzpatrick, S.*	..	..	..	..	..	..	..	..
Drogheda	St. Mary's National School	Mathews, J.	McGreevy, N.	Shea, M. J.; Dolan, J.	26	29	8	..	7	2	1 S. 2 B.	..
Drumlough	*National School*	*Chambers, J.*	*M'Clelland, J.*	*Mackintosh, J.*	..	..	..	..	..	..	..	..
Dublin	Central Model School	Newell, W. H.	Butler, H.	Joyce, P. W.; Smeethe, J. F.	97	127	30	..	30	31	1 B.	..
"	King's Hospital School	Flynn, J. H.	Dobbin, Rev. W. P.	Macbeth, J.	..	48	48	..	..	6	..	..
"	55, Aungier Street	West, Very Rev. J.	Hackett, Rev. J. W.	Goff, W. H.; Nevin, D.	..	21	21	..	..	4	..	..
Dundalk	Free Library	Byrne, P. J.	Hesse, J.	Lyons, M.; Armstrong, G.; M'Ewen, H.; Leonard, T. R.; Gillespie, I.	28	62	34	..	46	52	..	1 G.
"	Quay Street School											
"	Educational Institution											
"	Jocelyn Street School											
Dungannon	*Erasmus Smith's School*	*Newton, C.*	*Gaussen, Rev. E. J.*	*Orr, J.*	..	..	..	..	..	..	..	..
Eglish	National School	Robinson, Rev. G.	Kane, Rev. J. B.	Hyde, S.	..	51	51	..	..	5	..	..
Enniscorthy	Model School	Craufield, T. G.	Boland, G. H.	Kelly, D.	29	40	11	..	4	7	..	..
Enniskillen	Town Hall	Greer, Rev. S.	Bagot, E.	Doogan, P.	12	17	5	..	1	2	..	..
Enniskillen	*Model School*	*Greer, Rev. S.*	*Bagot, E.*	*Morris, C.*	..	..	..	..	..	..	..	..
Galgorm	National School	Young, J.	Raphael, J., jun.	M'Ilroy, H.	31	36	5	..	11	16	..	1 B.
Galway	Model School	Persse, T. M.	Gordon, J.	Moylan, J.	40	48	8	..	7	5	..	..
Gilford	National School	McMaster, J. W.	Kidd, H.	Martin, H.	..	35	35	..	..	8	..	..
Greyabbey	*National School*	*Montgomery, H.*	*Hall, Rev. W.*	*Walker, W.*	..	..	..	..	..	..	..	..
Holywood	Sullivan's Schools and Academy.	Henderson, Rev. H.	Monck, C. E. B.	Speers, A.; Carse, W.; Drennan, A.; Jenkinson, E. D.	75	76	1	..	24	18	..	..

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1867.	1868.	Increase.	Decrease.	Number of Prizes. 1867.	1868.	Number of Medals. 1867.	1868.
Irvinestown	*National School*	*Evans, Rev. S.*	*M'Quaid, Rev. J.*	*Magennis, P.*	..	..	..	..	..	..	..	..
Kilkee	*National School*	*Cleary, Rev. M.*	*M'Donnell, M.*	*Devine, M. J.*	..	..	..	..	..	..	..	..
Kilkenny	Model School	Blunden, Sir J., Bart.	De Montmorency, Rev. W.	Ryan, L. J.	59	46	..	13	16	9	1 G.	..
Killylea	*Schoolhouse*	*Cross, Lt.-Col. W.*	*Ellis, Rev. T.*	*Brownlee, T.*	..	..	..	..	..	..	..	..
Kilmore	*Kilmore School*	*Irwin, Rev. C. K., jun.*	*Paton, Rev. J.*	*Baile, R.* *Hyde, S.*	..	..	..	..	..	..	..	..
Kircubbin	*National School*	*Lyle, Rev. E. A.*	*Rowan, Rev. J.*	*Walker, W.*	..	..	..	..	..	..	..	..
Larne	Model Agricultural School	Morgan, Rev. T. P.	Eccles, Wm.	Hay, W.	24	49	25	..	14	15	..	..
"	North End National School	" "	"	O'Neill, S.	17	41	24	..	10	10	..	..
Letterkenny	*National School*	*Gallagher, J.*	*Barrett, J.*	*M'Caffery, W.*	..	..	..	..	..	..	..	..
Ligoniel	Wolfhill Mill	Montgomery, J.	Orr, W.	Barbour, S.	27	19	..	8	8	5	..	..
Lisbellaw	*Court-house*	*Wilson, Rev. J.*	*Rudd, Rev. T.*	*Doogan, P.*	..	..	..	..	..	..	..	..
Lisded	*National School*	*Reade, Rev. L.*	*M'Nulty, Rev. T.*	*Magennis, P.*	..	..	..	..	..	..	..	..
Lisnagry	*Ahane National School*	*Bourke, R.*	*Walsh, Rev. J.*	*Carey, J.*	..	..	..	..	..	..	..	..
Lough Cutra	*National School*	*Gough, G. S.*	*Stapleton, W. R.*	*Cusack, M.*	..	..	..	..	..	..	..	..
Loughgall	*School-room*	*Cope, J. A. M.*	*Thompson, W. jun.*	*Orr, J.*	..	..	..	..	..	..	..	..
Lurgan " "	National School Model School Mechanics' Institution	Hancock, J.	-	Mooney, T. Porter, G. English, W.	58	61	3	..	3	18	..	..
Magherally	*National School*	*Corken, R.*	*Reade, Rev. G. F.*	*M'Cahy, A.*	..	..	..	..	..	..	..	..
Manorhamilton	*Mutual Improvement Assembly Rooms.*	*Donnelly, J. O.*	*Shaw, S.*	*Birney, J.*	..	..	..	..	..	..	..	..
Markethill	Coolmalish National School	O'Toole, Rev. D.	Cuming, W.	Lee, H. Nugent, F.	..	20	20	..	..	4	..	..
Monaghan	*Model School*	*Lloyd, J.*	*Eardley, F.*	*M'Entee, M.* *Lineham, P.*	..	..	..	..	..	..	..	..
Moneyrea	*National School*	*Thompson, Rev. D.*	*M'Master, D.*	*Conkey, W. A.*	..	..	..	..	..	..	..	..
Newry	Model School	Dodd, Rev. J.	Porter, D. C.	Leonard, F. M.	..	41	41	..	..	..	..	..
Newtownards	Model School	Young, Rev. J.	Macdonnell, J.	Harbison, M. Greer, W. H. O'Reilly, J. C. Scott, S. M.	109	134	25	..	58	50	1 S.	1G 1S 1B
Newtownards	*East Street National School*	*Macaulay, Rev. M.*	*Doggart, H. J.*	*M'Kinm, S.*	..	..	..	..	..	..	..	..
"	*16, Regent Street*	*Young, Rev. J.*	*M'Laughlin, T.*	*Montague, J.*	..	..	..	..	..	..	..	..

Newtownbreda	National School	Kennedy, J.	Anderson, Rev. W.	Erwin, M.	..	88	88	..	..	..	..	..
Oldcastle	Endowed School	Durdin, Rev. J. G.	O'Neill, R.	Beatty, J. Smyth, A.	100	190	30	..	65	40	..	1 S. 1 B.
Omagh	*Model School*	*Byrne, Rev. J.*	*Adair, S.*	*Ferguson, S. H.*	..	..	..	..	..	..	..	..
Parsonstown	*Model School*	*The Earl of Rosse*	*Brown, S.*	*Muldoon, C.*	..	..	..	..	..	..	..	..
Portadown	Town Hall	Shillington, T. A.	Donnelly, Rev. J.	Hyde, S.	18	80	12	..	17	9	..	..
Portadown	*Edenderry Nat. Sch.*	*Armstrong, T.*	*Wallace, H.*	*Martin, H.*	..	..	..	..	..	..	..	..
Raphoe	National School	Thomson, Rev. J.	Wilson, T.	Cotter, E. G.	9	18	9	..	1	10	..	..
Raphoe	*Court-house*	*Weir, Rev. J. A.*	*Morrow, H.*	*Cotter, E. G.*	..	..	..	..	..	..	..	..
Rathfryland	*Town Hall*	*Smyth, Rev. E.*	*Meek, B. B.*	*Williams, T. M.*	..	..	..	..	..	..	..	..
Roscrea	National School	Meagher, Rev. J.	Somers, J. L.	McGrenahan, E. Kelly, T. Ryan, M.	..	9	9	..	..	7	..	..
Rosscarbery	*Mount Fachnanus Nat. Sch.*	*Lucey, Rev. J.*	*Mulcahy, Rev. J.*	*Prendergast, P.*	..	..	..	..	..	..	..	..
Santry	Training School	West, Very Rev. J.	Hackett, Rev. J. W.	Engledow, W. H. Mayne, A. J.	60	60	..	..	44	87	1 S. 3 B.	1 S. 3 B.
Scariff	*National School*	*Sampson, F. C.*	*O'Mailey, Rev. P.*	*O'Gorman, T.*	..	..	..	..	..	..	..	..
Sixmilecross	*National School*	*Mann, D.*	*Junk, Rev. T. W.*	*Crooke, S.*	..	..	..	..	..	..	..	..
Stewartstown	*School-room*	*M'Curdy, Rev. S.*	*Jones, Rev. J. W.*	*Hyde, S.*	..	..	..	..	..	..	..	..
Tandragee	*Duke's School*	*O'Brien, J. S.*	*Victor, W. L.*	*Macgowan, F. M.*	..	..	..	..	..	..	..	..
Trim	Model School	Lightburne, H.	Conwell, E. A.	Freehill, M.	72	62	..	10	15	28	..	..
Tullynamullen	*National School*	*Johnston, Rev. W.*	*M'Neice, S.*	*Allen, D.*	..	..	..	..	..	..	..	..
Waterford	Model School	Hoare, Very Rev. E.	Cavet, James	Dowling, J.	28	55	27	..	2	8	..	..
Waterford	*Newtown School*	*Hoare, Very Rev. E.*	*Cavet, J.*	*Cane, J. B. N.*	..	..	..	..	..	..	..	..
„	*Leper Hospital*	„	„	„	..	..	..	..	..	..	..	..
				Total	8,859	14,068	5209	—	2,299	3,650		

TABLE II.

TABLE showing the CLASSES in each of the preceding SCIENCE SCHOOLS, the SUBJECTS taught, and the NUMBER of STUDENTS in each Subject. March 1869.

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
										ENGLAND.															
Abingdon	British School	44	..	..	..	..	..	..	..	..	..	12	..	..	..	30	..	2	..	..	..	..	..	..	..
Accrington	Mechanics' Institution	37	19	19	19	..	..	..	..	10	11	15	9	..	..	13	..	..	..	..	..	..	..	..	..
Alderley Edge	Reading Room and Library	13	13	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Almondbury	Grammar School	16	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..
Alnwick	Mechanics' Institution	38	..	..	..	12	..	..	..	..	..	26	..	..	..	..	..	..	..	..	..	..	..	..	..
Altrincham and Bowdon.	Literary Institution	45	45	5	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Andover	Grammar School	30	..	..	..	..	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	15
Ashby-de-la-Zouch	Mutual Improvement Society.	24	..	..	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..
Ashton-under-Lyne	Mechanics' Institution	22	22	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Aston	Christ Church Mutual Improvement Society.	15	..	..	..	..	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..
Bacup	Mechanics' Institution	34	17	17	17	..	..	10	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..
"	Wesleyan Day Schools	30	..	..	..	..	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..
Balham	Working Men's Institute	18	18	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Banbury	British School	24	..	..	..	10	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	15
"	Mechanics' Institution	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11	..	..	..	..	..	..
Banstead	School-room	30	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Barnard Castle	Mechanics' Institution	8	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Barnsley	Market Street School	20	20	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Barnstaple	Literary and Scientific Institution.	60	..	..	..	60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Batley	Mechanics' Institute	9	..	..	..	..	..	..	..	9	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..
Beccles	Leman School-room	9	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9
Bedford	St. Mary's Parish School	21	..	..	..	..	..	..	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..
Bingley	Mechanics' Institution	21	..	..	..	..	..	..	..	..	6	20	..	..	..	..	..	..	..	..	..	..	..	..	..

Birkenhead	School of Art	20	20	8	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Birmingham	Birmingham and Midland Institute.	207	..	..	..	..	..	..	..	50	..	187	..	..	..	12	..	4	..	..	..	..	..	..	40
„	School of Art	78	9	59	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Clarendon Chambers	24	..	10	6	..	..	..	..	..	10	6	..	..	..	4	..	..	..	..	..	..	..	..	..
„	Bloomsbury Institute	100	23	28	9	..	..	..	..	10	34	14	..	8	..	29	..	..	..	..	..	..	..	..	18
„	Graham Street Institute	24	..	..	..	..	..	..	..	..	..	18	..	..	..	18	..	..	..	..	..	..	..	..	..
„	Church of the Saviour School.	12	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	St. George's School	47	..	..	..	..	..	..	..	..	..	..	..	..	..	47	46	..	..	..	..	..	..	..	..
„	St. Paul's School	33	..	..	..	..	..	..	..	..	33	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	12, Ann Street	18	..	..	..	..	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..
„	St. Mary's School	14	..	..	..	..	..	..	..	..	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..
„	St. Mark's School	40	..	..	..	..	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	39
„	St. Clement's School	17	..	16	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Deritend Working Men's Association.	24	..	..	..	4	..	4	..	..	20	..	..	..	..	20	..	..	..	..	..	..	..	..	..
„	New Jerusalem School	8	..	..	..	..	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..
„	Middle Class School	16	16	16	16	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Bishop Ryder's National School.	41	15	..	..	..	..	..	..	..	..	26	..	..	..	..	..	..	..	..	..	..	..	..	..
Birstall	Mechanics' Institution	48	..	..	..	..	..	..	..	..	39	48	26	..	..	..	..	..	..	..	..	..	..	..	29
Blackburn	Wesleyan School	31	18	18	18	..	..	..	..	7	10	12	2	..	..	16	3	..	..	..	..	..	..	..	..
„	Church Institute	9	..	..	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	7
Blackley	Assembly Room	31	31	31	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Blyth	Waterloo School	48	48	48	48	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bodmin	Literary Institution	60	..	..	..	..	..	..	..	..	8	..	..	..	..	60	..	..	..	..	..	..	..	..	6
Bolton	Science and Art School	165	45	55	45	20	..	18	18	14	14	45	..	6	..	28	..	8	..	..	12	..	..	6	18
„	Mechanics' Institution	60	40	50	45	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Boston	National School	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	17	..	..	..
„	School of Art	16	6	8	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bow, North	Old Ford School-room	17	17	17	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bradford	Mechanics' Institution	14	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..
Breage	Wheal Vor, Sithney, and Cross.	60	..	..	..	..	..	..	..	..	..	60	..	60	60	..	..	..	..	60	..	..	..	..	..
Brigstock	Farming Woods School	30	..	..	..	2	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..
Bristol	Trade School	175	115	125	90	95	..	83	60	..	83	95	95	..	..	..	..	..	..	3	..	..	..	..	..
„	Young Men's Christian Association.	22	..	..	..	..	..	..	..	..	8	16	..	..	..	9	..	..	..	..	..	..	..	..	..
Brixworth	Boys' School-room	25	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bromsgrove	Literary and Mechanics' Institution.	62	..	..	..	..	..	..	..	..	..	7	..	..	..	58	..	..	..	..	..	..	..	..	..
Buckingham	National School	11	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Burnley	Literary Institution	46	..	..	..	..	..	10	..	..	6	8	2	..	..	14	..	6	..	..	..	..	..	..	30
„	Carlton Road School	59	..	..	..	..	..	..	..	..	..	55	..	..	..	19	..	..	..	..	..	..	..	..	..
„	Mechanics' Institution	66	..	36	36	..	..	4	..	..	3	7	2	..	..	14	..	..	..	..	..	..	..	..	20

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Burnley - -	Grammar School - -	50	..	..	..	..	..	..	..	..	..	45	..	20	..	..	..	..	..	..	..	..	..	..	..
Bury - - -	Athenæum - - -	70	65	60	60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Caistor - -	Lower Grammar School -	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10
Camborne - -	Basset Street - -	12	..	..	..	..	..	..	..	..	..	12	..	..	12	..	..	..	..	..	..	..	..	..	..
Canning Town -	Holy Trinity Schools -	29	29	29	29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cardiff - -	Free Library - - -	30	14	20	18	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Carharrack - -	Literary Institution - -	17	..	..	..	..	..	..	..	..	..	17	..	..	17	..	..	..	..	..	..	..	..	..	..
Chatham - -	St. Mary's School - -	60	60	60	60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	St. Mark's, New Brompton -	40	40	40	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cheltenham - -	School of Science, Clarence Parade.	15	..	..	..	2	1	2	..	2	5	8	..	..	..	3	..	..	..	..	4	..	..	..	..
" - -	Training College - -	50	..	..	..	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Whitworth School - -	260	..	..	..	12	..	25	25	35	203	81	49	12	..	20	6	6	..	..	20	..	..	..	14
Chester - -	Mechanics' Institution -	12	..	11	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chorley - -	St. George's National School	15	15	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Church - -	National School - -	57	..	..	..	..	..	..	..	..	..	41	..	..	..	57	..	..	..	..	..	..	..	..	..
Colne - -	Grammar School - -	24	24	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Compstall - -	Athenæum - - -	25	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Coventry - -	St. Peter's National School -	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Cradley - -	School-room - - -	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Creaton, Great -	National School - -	20	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Crewe - -	Mechanics' Institution -	30	26	30	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Croydon - -	Literary Institution - -	14	14	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Culham - -	Training College - -	21	..	..	..	12	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	20
Darlington - -	Mechanics' Institute -	15	..	..	..	4	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..
Dartford - -	National School - -	23	23	23	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20	4	..	..
Dartmouth - -	Mutual Improvement Society.	33	..	..	..	19	..	..	..	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Darwen	Mechanics' Institution	8	..	..	..	..	..	..	..	..	8	..	..	..	..	8	..	..	..	..	..	..	..	..	..
Daventry	Grammar School	15	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Denton and Haughton.	Mechanics' Institution	30	30	..	..	..	..	..	..	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Deptford	St. Paul's Boys' School	77	50	45	50	27	..	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Mechanics' Institution	17	17	17	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Derby	Grammar School	10	..	..	..	..	..	..	..	..	..	10	..	..	..	10	..	..	..	..	..	..	..	..	..
Devonport	Mechanics' Institution	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9	9	..	..	..	..	..	..
Dewsbury	Mechanics' Institution	15	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..
Doncaster	The Guildhall	10	7	5	3	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Droylsden	Educational Institute	48	43	43	43	..	..	..	..	..	..	8	8	..	..	..	..	..	..	..	..	..	..	..	..
Dudley	Mechanics' Institution	48	5	5	..	..	..	..	..	..	..	18	..	..	..	30	..	..	..	..	..	..	..	..	..
"	Blue Coat School	45	..	..	..	..	..	..	..	..	..	45	..	..	..	..	..	..	..	..	..	..	..	..	..
Dukinfield	Old Chapel Sunday School	31	31	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Moravian Boys' School	14	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Durham	Training College	18	..	..	..	11	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	18
Eagley	Institute	20	..	..	..	..	..	..	..	..	..	7	..	..	..	14	..	..	..	..	..	..	..	..	9
Earlestown	Mutual Improvement Society.	25	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Earls Barton	British School	51	..	..	..	..	..	..	..	..	51	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Eastington	National School	10	7	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Eastwood	Mechanics' Institution	9	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Elland	Science School, Southgate	30	30	..	..	..	..	..	..	8	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..
Eston	Parochial Institute	12	..	..		..	..	..	..	..	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Exeter	Albert Memorial Museum	31	..	..	..	13	..	..	..	..	..	9	..	9	..	5	..	9	9	..	..	..	..	..	..
Failsworth	Mechanics' Institution	20	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Farnworth	Grammar School	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" and Kersley.	Mechanics' Institution	15	15	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Flore	Endowed School-house	28	..	..	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Friezland	Christ Church Parochial School.	11	11	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gateshead	National Schools	58	17	58	7	10	..	7	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..
Glossop	Working Men's Institute	42	42	42	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gloucester	Blue-coat School	33	..	..	..	33	..	..	..	33	33	33	33	..	..	..	..	..	..	..	..	..	..	..	..
"	10, Eastgate Street	17	..	..	..	..	..	..	..	..	14	13	13	13	..	12	..	..	..	..	12	..	..	..	..
Gomersal	Mechanics' Institution	18	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..
Grantham	National School	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Greenwich	Girls' National School	21	21	21	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Halifax	Working Men's College	47	17	..	..	..	..	..	..	..	..	30	16	..	..	..	..	..	..	..	..	..	..	..	..
Halliwell	Dean Mills	15	15	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hampton	Commercial School	28	..	28	..	..	..	..	..	..	..	26	..	..	..	..	..	..	..	..	..	..	..	..	..
Haslingden	Institute	31	15	15	15	..	..	7	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..

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Helston -	Grammar School -	19	..	..	..	..	..	..	..	..	..	19	..	..	19	..	..	..	..	..	19	..	..	..	..
Hetton -	Colliery Schools -	86	86	86	25	..	..	..	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Heywood -	Mechanics' Institution -	18	10	10	10	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..
Hingham -	National School -	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	22
Hollinwood -	Working Men's Club and Institute.	16	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Holywell Green	Mechanics' Institution -	10	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..
Hopwood -	Methodist Free Church School.	18	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..
Huddersfield -	Mechanics' Institution -	73	24	24	24	..	..	..	..	..	..	29	29	..	..	..	..	..	..	..	..	..	..	..	..
Hull - -	Nautical Schools -	72	..	..	..	34	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	70	70	30	29
Huntingdon -	Walden's School -	15	..	..	..	..	..	..	..	3	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Hurst -	Mechanics' Institution -	11	11	11	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hyde -	Mechanics' Institution -	42	24	24	24	..	..	..	..	10	10	14	..	..	..	14	..	..	..	..	..	..	..	..	..
Kendal -	Post Office Yard Room -	80	..	..	..	..	..	..	..	..	..	80	..	..	..	27	..	..	..	..	..	..	..	..	..
Kersley -	British School -	16	..	..	..	..	..	..	..	..	..	16	..	..	..	16	..	..	..	..	..	..	..	..	..
Kettering -	National School -	48	..	..	..	..	..	..	..	18	..	..	..	..	..	48	..	..	..	..	..	..	..	..	..
" -	British School-room -	20	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kidderminster -	Mutual Improvement Society.	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6
Kilburn -	St. Mary's School -	20	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kingsbridge -	Town Hall - -	15	..	..	..	..	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..
Kinver -	Mill Room - -	18	..	..	..	..	..	..	..	..	..	11	4	..	..	7	..	..	..	..	..	..	..	..	..
Lamport -	Endowed School -	44	..	..	..	..	..	..	..	..	44	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lancaster -	Mechanics' Institution -	64	..	..	..	6	..	..	..	..	..	43	..	5	..	40	..	..	..	..	..	..	..	..	..
Langdale -	Endowed National School -	21	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Leeds - -	Mechanics' Institution and Literary Society.	102	..	..	..	46	..	33	..	30	..	38	9	..	..	30	..	..	..	..	3	..	..	..	..
,, - -	St. Peter's National School -	24	..	..	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..
,, - -	,, ,, (School-master's Class).	33	..	..	..	..	..	..	..	..	..	33	33	..	..	..	..	..	..	..	..	..	..	..	..
,, - -	Young Men's Christian Association.	25	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..
,, - -	Working Men's Institute -	20	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..
Lees - - -	Parish Church Schools -	35	35	30	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Leicester - -	St. Martin's School - -	34	..	..	..	30	..	..	..	10	54	22	10	..	..	..	..	..	..	..	..	..	..	..	..
,, - -	St. Margaret's National School.	45	..	..	..	15	..	..	..	..	80	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Leighton Buzzard -	Mutual Improvement Society.	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Lewes - -	School of Art - - -	15	..	5	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lewisham - -	St. Mary's National School -	25	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Limehouse - -	St. Anne's National School -	20	20	..	..	..	..	..	..	20	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..
Lincoln - -	Training School - -	43	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	43
Liverpool - -	Free Library and College -	90	..	..	..	..	..	15	..	30	82	40	..	..	..	19	8	..	..	..	..	..	..	..	..
,, - -	Institute - - -	144	..	..	..	102	..	..	..	..	..	124	..	..	..	..	..	..	..	..	..	5	..	..	..
Llanelly - -	Copper Works School -	74	13	43	43	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10	10	..	12
London:—																									
Battersea - -	St. John's College - -	80	..	..	..	80	..	..	..	..	..	..	..	..	..	60	..	..	..	..	..	..	..	..	80
,, - -	Sir Walter St. John's School	71	..	..	..	38	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	71
,, - -	Christ Church Schools -	45	..	..	..	..	..	..	..	..	..	..	..	..	..	45	..	..	..	..	..	..	..	..	..
,, - -	Working Men's Club -	16	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..
Bermondsey -	Christ Church Schools -	10	10	10	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,, - -	Working Men's Institute -	17	17	4	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bethnal Green -	Birkbeck Schools - -	118	..	..	..	..	..	..	..	96	82	..	..	..	..	105	82	..	..	..	..	..	..	..	..
,, - -	National School - -	132	23	23	..	27	..	17	22	60	109	..	..	49	..	7	7	..	..	..	..	..	..	..	73
Brixton Hill -	Working Men's Club -	16	16	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chancery Lane -	Birkbeck Literary and Scientific Institution.	54	..	..	..	..	..	..	..	..	..	22	..	..	..	32	..	..	..	..	..	..	..	..	..
Chelsea - -	St. Mark's College - -	90	90	..	..	90	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	90
,, - -	Arthur Street - -	74	37	53	63	16	..	13	12	18	27	22	..	30	..	51	..	..	..	..	..	..	..	..	..
,, - -	Royal Military Asylum -	20	..	..	..	15	4	5	..	5	14	14	..	..	..	..	..	..	..	..	..	..	..	..	18
Dock Street -	Sailors' Home - -	305	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	305	305	..	..
Goswell Road -	St. Barnabas' National School	24	24	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gray's-Inn Road -	St. Jude's School - -	76	76	76	76	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Great Ormond St.	Working Men's College -	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..
Hackney - -	St. Thomas' Square School -	86	..	..	..	..	..	..	..	..	..	60	..	..	..	30	..	..	..	..	..	..	..	..	..
Islington, Lower -	Public School - -	167	31	31	..	..	..	..	..	..	68	96	..	..	..	100	70	..	..	..	..	..	..	..	70
,, - -	St. Silas' National School -	18	18	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kennington - -	St. John's Middle Class School.	5	..	..	..	..	..	..	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..

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Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
London—*cont.*																									
Kentish Town -	Gospel Oak School -	84	..	..	..	..	..	..	..	..	..	..	..	..	..	84	..	..	..	..	..	..	..	..	..
Knightsbridge -	Albert Working Men's Club	35	..	31	..	..	..	..	..	..	19	..	..	18	..	30	..	..	..	..	..	..	..	..	..
Lambeth -	Boys' School, Hercules Buildings.	201	42	140	140	..	..	..	..	..	..	..	..	102	..	..	..	..	..	..	..	..	..	..	159
" -	School of Art -	33	16	..	14	4	..	..	..	..	..	2	..	..	..	14	..	..	..	..	..	..	..	..	..
Leadenhall Street	City of London College	32	..	..	..	..	..	..	..	..	..	32	..	..	32	..	..	..	..	..	..	..	..	..	..
Long Acre -	Whitefield School-room	8	..	..	..	..	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..
Marylebone -	Central Boys' School	50	..	26	26	..	..	..	..	..	..	..	..	50	..	20	..	..	..	..	..	..	..	..	..
" -	Quebec Club -	28	28	28	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nine Elms -	Lecture Room -	26	16	22	24	..	..	..	..	..	16	..	..	17	..	26	..	..	..	..	..	..	..	..	..
Notting Hill -	Shaftesbury Hall -	16	16	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Paddington -	Greville House -	33	33	33	33	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Peckham -	Upper and Middle Schools -	270	..	..	..	20	..	130	..	..	..	..	..	..	..	30	40	..	..	..	..	..	..	..	80
Poplar -	All Saints' National School -	18	18	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Regent Street -	Royal Polytechnic Inst. -	30	..	..	..	..	..	..	..	10	12	20	..	..	..	6	..	..	..	..	6	..	..	..	..
South London -	Working Mens' College -	5	..	..	..	..	..	..	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..
Southwark -	Boro' Road Training College	94	..	..	..	87	..	41	..	..	..	88	..	..	..	..	..	..	..	..	..	..	..	..	94
" -	Boys' Model School -	50	..	..	..	..	..	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..
" -	Swan Street Boys' National School.	22	22	22	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Working Men's Club and Institute.	28	28	9	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stepney -	Red-coat School -	19	19	19	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Upper Berkeley Street, W.	Hampden Gurney Schools -	9	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..
Vauxhall -	Baptist Chapel School-room	43	43	43	43	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Wandsworth Road -	9	9	9	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Wandsworth	Royal Patriotic Fund Boys' School.	60	..	60	..	..	..	..	..	..	..	..	..	..	..	60	..	..	..	..	..	..	..	..	..
Waterloo Road	St. John's Schools	74	74	74	74	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Westminster	Wesleyan Training College	86	..	..	..	15	..	..	..	..	..	31	..	..	..	..	..	..	..	..	..	..	..	..	86
"	St. James the Less N. S.	36	26	26	26	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..
Luddenden Foot	Day School-room	37	..	..	..	..	..	..	..	..	..	..	..	..	..	37	..	..	..	..	..	..	..	..	..
Macclesfield	Modern Free School	41	..	..	..	..	..	..	..	..	..	41	..	..	..	..	..	..	..	..	..	..	..	..	..
Maldon	Mechanics' Institution	15	..	..	..	..	..	..	..	7	7	..	..	..	..	11	..	..	..	..	..	..	..	..	..
Manchester	Mechanics' Institution	280	127	127	127	..	..	24	24	60	60	120	..	..	..	110	..	..	..	..	100	..	..	..	60
"	Roby Society's School	23	16	16	16	..	..	..	..	..	..	6	6	6	..	..	..	..	..	..	..	..	..	..	..
"	Corporation Street	44	..	..	..	..	..	..	..	..	..	44	31	..	..	..	..	..	..	..	..	..	..	..	..
"	St. George's National School	8	8	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Hulme Working Men's Institution.	32	15	15	..	..	..	..	..	..	..	11	11	..	..	6	..	13	..	..	..	..	..	..	..
Masham	Grammar School	18	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..
Melton Mowbray	Church School-room	10	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..
Middlesborough	St. John's Schools	9	..	..	..	..	..	..	..	..	8	9	..	..	..	..	..	..	..	..	..	..	..	..	..
Middleton	National School	40	..	..	..	..	..	..	..	..	..	12	..	..	..	25	..	12	..	..	..	..	..	..	..
Millwall	Presbyterian School	12	12	..	..	..	..	..	..	12	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Modbury	The Institution	28	..	..	..	..	..	..	..	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	..
Monk Wearmouth	Colliery School	41	41	41	41	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Mossley	Mechanics' Institution	22	22	22	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nailsworth	National School-room	11	..	..	..	..	..	..	..	..	..	..	..	11	..	11	..	..	..	..	..	..	..	..	..
Nelson-in-Marsden	Lomeshaye Schools	34	..	..	..	14	..	..	..	22	20	..	9	..	..	..	..	..	..	..	..	..	..	..	..
Newark	Mechanics' Institution	24	..	..	..	..	..	..	..	18	..	10	..	..	..	8	..	..	..	..	..	..	..	..	..
Newcastle-on-Tyne	Elswick Works Mechanics' and Literary Institute.	136	80	80	80	20	..	..	30	..	..	26	..	..	..	..	..	..	..	..	..	..	..	..	..
New Mills	News Room, Market Street	11	11	11	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Newton	School-room	25	..	..	..	..	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..
Newton Heath	All Saints National School	18	..	..	..	..	..	..	..	6	..	12	..	..	..	14	..	..	..	..	..	..	..	..	..
"	Dixon Street	12	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Northampton	Museum and Town Hall	136	..	..	..	..	..	..	..	78	133	..	..	..	..	..	..	..	..	..	..	..	..	..	..
North Ormesby	Church Institute	7	..	..	..	..	..	..	..	..	7	7	..	..	..	..	..	..	..	..	..	..	..	..	..
Nottingham	Mechanics' Institution	126	..	..	..	..	..	..	..	5	11	38	..	8	..	30	..	..	..	..	..	..	..	..	40
Oldbury	National School	54	..	..	..	..	..	..	..	..	..	..	..	48	..	54	..	..	..	..	..	..	..	..	..
"	Messrs. Chance's Institute	83	..	..	..	..	..	..	..	..	..	..	..	..	..	83	..	..	..	..	..	..	..	..	..
Oldham	Science and Art School	91	75	71	33	25	..	18	25	..	..	4	..	..	..	..	..	6	..	..	..	..	..	..	..
"	Glodwick Mutual Improvement Society.	59	45	40	40	35	..	25	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Analytic Literary Institute	27	27	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Parish Church School	..	..	..	..	..	..	..	..	..	..	..	..	..	..	-	..	..	..	..	..	..	..	..	..
Openshaw	Ashbury Carriage Works	28	23	28	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Wesleyan Day School	28	28	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Owston Ferry	Wesleyan School	2	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Oxford -	- Town Hall - - -	16	..	..	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..
Padiham -	- National School - -	12	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Patricroft -	- Mechanics' Institution -	14	14	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pavenham -	- Church of England School-room.	25	..	..	..	..	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..
Pembroke Dock -	Mechanics' Institution -	15	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pendeen -	- National School - -	7	..	..	..	..	..	..	..	..	..	7	..	..	7	..	..	..	..	..	..	..	..	..	..
Pendleton -	- Mechanics' Institution -	15	..	9	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	- Pendleton Club - -	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Penzance -	- School of Science and Art -	28	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Peterborough	- St. Peter's College - -	36	..	..	..	..	..	..	..	..	..	..	..	..	..	36	..	..	..	..	..	..	..	..	13
Plumstead -	- Burrage Road School -	71	61	61	61	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..
Plymouth -	- Courtenay Street - -	146	16	8	{8, *14}	31	6	9	5	12	15	20	10	..	..	5	5	16	16	..	..	2	1	12	9
" -	- Buckwell Street - -	9	..	..	..	..	..	..	..	..	6	8	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	- Navigation School - -	23	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20	20	..	..
" -	- Charles National School -	90	..	30	15	..	..	..	..	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30
Portland -	- The Grove School - -	27	..	..	..	12	..	27	..	1	..	..	..	..	..	1	..	..	..	..	..	..	..	..	1
Preston -	- Institution, Avenham -	76	28	29	28	7	..	5	..	12	8	32	11	9	..	8	..	..	..	..	..	..	..	..	..
Ramsbottom	- Public Institute - -	9	9	9	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rawmarsh -	- Free Church School-room -	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rawtenstall -	- Mechanics' Institution -	85	85	85	85	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Redditch -	- Literary and Scientific Inst.	86	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	6
Redruth -	- The Institution - -	19	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	19
Riddings -	- Mutual Improvement Assoc.	19	..	19	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..
Rochdale -	- British Schools - -	110	93	98	98	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..
Royton -	- St. Paul's National School -	48	48	40	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Runworth -	Sunnyside Institute -	15	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Saddleworth -	Mechanics' Institution -	16	16	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
St. Helen's -	Commercial School -	20	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..
St. Just -	The Institution -	5	..	..	..	..	..	..	..	..	..	5	..	..	5	..	..	..	..	..	..	..	..	..	..
Salford -	Working Men's College -	76	20	24	15	..	..	..	..	..	..	7	16	7	7	2	..	8	8	..	..	..	..	..	18
" -	The Egerton Schools -	84	..	..	..	..	..	..	..	..	..	84	..	..	..	..	..	..	..	..	..	..	..	..	..
Saltaire -	Literary Institute -	23	..	..	..	..	..	..	..	..	11	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Saltley -	Training College -	65	..	..	..	24	..	..	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..	24
Scarborough -	Mechanics' Institutio -	18	..	..	..	7	..	..	..	..	..	..	..	4	..	5	..	..	..	..	..	8	..	..	8
Shaw - -	National School -	26	26	26	26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sheffield -	Christian and Educational Institute.	15	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	St. Paul's School -	21	..	..	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	St. George's School -	8	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Church Institute -	35	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16
Slough -	Mechanics' Institution -	48	48	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Southampton -	The Hartley Institution -	229	..	5	..	12	..	4	..	216	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..
Southminster -	National School -	23	..	..	..	..	..	..	..	19	18	..	..	..	..	22	..	..	..	..	..	..	..	..	..
Southport -	Athenæum -	18	13	18	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
South Shields -	Mechanics' Institute and Jarrow Chemical Company's Works.	78	..	42	42	..	..	..	..	..	..	36	..	..	..	..	..	..	..	..	..	..	..	..	..
Southwick -	Working Men's Reading Room.	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stainland -	Independent School -	9	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..
Stalybridge -	Mechanics' Institution -	19	19	19	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stockport -	Mechanics' Institution -	64	..	24	..	..	..	..	..	22	6	6	..	12	..	6	..	..	..	..	..	..	..	..	22
" -	Sunday School Improvement Society.	65	19	19	19	..	..	..	..	..	..	20	..	..	..	20	..	..	..	..	..	..	..	..	..
Stonehouse -	The Institute -	6	..	..	..	..	..	..	..	..	..	6	..	6	..	6	..	..	..	..	..	..	..	..	..
Stourbridge -	Grammar School -	16	..	..	..	..	..	..	..	..	..	16	..	..	..	9	..	..	..	..	..	..	..	..	..
Stratford -	Working Men's Hall -	49	49	49	49	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stroud -	The Institute -	71	..	..	..	..	..	..	..	..	..	23	..	35	..	8	..	..	15	..	..	..	..	..	..
Swansea -	Royal Institution of South Wales and Oxford Street National School.	58	..	..	..	50	..	6	6	4	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tavistock -	British School -	72	..	..	..	6	..	..	..	8	21	27	..	..	..	55	..	..	..	..	..	..	..	..	..
" -	Gulworthy School -	68	..	11	..	..	..	..	..	44	..	..	..	..	..	5	..	..	..	..	..	..	..	10	48
" -	National School -	59	..	..	..	..	..	..	..	..	..	42	..	..	..	..	..	..	..	..	..	..	..	..	53
" -	St. Mary Tavy National Sch.	14	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..
Tebworth -	Wesleyan School -	8	..	..	..	..	..	..	..	..	4	4	..	..	..	..	..	..	..	..	..	..	..	..	..
Thorne -	Brooke's Grammar School -	15	9	2	2	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Thorpe -	St. Matthew's Boys' School -	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8
Toddington -	National School -	6	..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..

* Naval Architecture.

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Torquay	School of Science and Art	46	..	..	..	..	..	..	..	8	44	..	..	..	..	8	..	..	..	..	..	..	..	..	..
Towcester	National Schools	28	..	..	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Truro	British Schools	14	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	14
"	Royal Institution	24	..	..	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..
Turton	Chapel Town Institute	25	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tyldesley	Mechanics' Institution	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ulverstone	Temperance Hall	9	..	..	..	6	..	..	..	..	..	..	..	..	..	5	..	..	..	..	..	..	..	..	..
Wakefield	Holy Trinity Young Men's Society.	18	..	..	..	..	..	..	..	..	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Mechanics' Institution (Schoolmaster's Class).	22	..	..	..	..	..	..	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..
Warrington	Museum and Free Library	25	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..
Weedon	Girls' School	28	..	..	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wellingborough	Lower Grammar School	52	..	..	..	..	..	..	..	9	28	..	..	..	..	33	..	..	..	..	..	..	..	..	..
Werneth	Mechanics' Institution	25	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
West Bromwich	St. Peter's Schools	30	..	..	..	..	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	12
Westbury-on-Trym	Girls' National School	36	36	36	36	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
West Gorton	St. Mark's National School	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Whaleybridge	Mechanics' Institution	14	14	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Whitworth	Literary Institution	26	26	26	26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wigan	Town Hall	50	26	24	..	..	..	..	..	..	..	12	..	14	..	..	..	..	..	16	8	..	..	..	..
Wilsden	Mechanics' Institution	14	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..
Windsor	Mechanics' Institution	22	22	22	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wisbech	Working Men's Institute	33	..	..	..	..	..	..	..	..	15	..	..	..	..	30	..	..	..	..	..	..	..	..	..
Woking	St. John's School	35	..	..	..	..	..	..	..	..	..	20	..	..	..	24	..	..	..	..	..	..	..	..	30
Wollaston	Church of England Schools	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..

Wolverhampton	Athenæum Class	14	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Peter's School	50	..	..	..	12	..	12	..	25	..	..	..	..	..	50	25	..	..	..	..	..	..	12
"	St. Luke's School	18	..	..	..	..	..	2	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..
"	St. John's "	11	..	..	..	..	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	9
Wolverton	Science and Art Institute	58	24	24	..	12	..	12	..	44	44	34	34	..	..	28	..	..	..	..	..	..	..	..
Woodville	National School	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..
Woolwich	Royal Arsenal Sci. Classes	184	68	68	68	48	..	24	24	..	24	66	..	5	..	..	..	..	..	..	18	..	..	..	..
"	National School	50	32	50	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Thomas' School	112	52	52	51	35	..	35	..	6	15	15	..	..	..	..	..	..	..	..	15	..	..	..	..
"	Presbyterian District School	120	60	60	60	..	..	..	..	..	..	40	..	100	..	..	..	..	..	..	..	..	..	..	30
"	St. Michael's School	33	33	33	33	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Rectory Place School	21	21	21	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	13, Dundas Terrace	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	23
Worcester	Guildhall	57	..	..	..	..	..	..	..	4	6	13	..	11	..	36	..	..	..	..	18	..	..	..	..
"	School of Art	38	24	38	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Workmen's Hall, &c.	65	..	..	..	..	..	..	..	42	..	..	..	5	..	42	5	..	..	..	..	..	..	..	41
Yarmouth, Great	Navigation School	100	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	100	100	..	..
York	The Institute	51	..	..	..	15	..	15	..	..	..	26	..	8	..	..	..	..	..	..	..	..	..	..	10
"	Blue-coat School	19	..	..	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..	..	..	19
"	Training College	20	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6

SCOTLAND.

Aberdeen	Mechanics' Institution	76	..	..	..	50	..	44	..	..	..	..	..	..	..	3	..	4	19	..	..	..	..	..	..
"	Navigation School	298	..	..	..	76	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	246	211	..	..
Aboyne	Parish School-room	24	..	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Alexandria	Mechanics' Institution	99	..	..	..	17	..	48	..	..	..	43	..	..	..	..	..	..	..	..	..	..	..	..	..
Banchory	Lady Burnett's School	17	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Banton	Banton School	10	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Beith	New Street School	16	..	..	..	6	..	1	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Brechin	School-room	45	16	..	..	14	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..
Corsock	Girls' School	10	..	..	..	..	..	..	..	..	..	..	..	..	..	6	..	4	..	..	..	..	..	..	..
Cults	School-room	15	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cupar	Madras Academy	43	..	..	..	37	..	..	..	7	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..
Dalry	Blair Iron Works School	16	..	14	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dumbarton	Burgh Academy	126	12	..	..	16	..	..	..	..	..	..	..	..	..	60	..	..	..	..	..	..	..	..	66
Dundee	High School	81	81	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Edinburgh	Free Church Training College	79	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	59
"	Watt Institution	449	..	..	..	159	..	141	..	..	..	146	..	..	..	..	..	..	..	..	..	..	..	..	..
Glasgow	Secular School	78	17	17	..	..	..	..	..	..	..	18	..	..	..	76	50	..	..	..	18	..	..	..	50

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Glasgow - -	Anderson's University -	1013	..	..	..	22	..	..	22	..	276	516	516	..	..	266	..	103	103	..	..	..	..	..	..
„ - -	Mechanics' Institution -	30	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	Established Church Normal School.	50	..	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..	..	..	..	..
Inverness - -	School of Science and Art -	31	10	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kilmarnock - -	Fould's Street - -	102	50	57	..	53	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	New Academy - -	41	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	41
Kirkwall - -	Grammar School - -	32	20	..	..	32	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	23
Leith - -	Navigation School - -	309	..	..	..	102	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	206	203	70	..
Newhills - -	Stoneywood School-room -	30	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Perth - -	School of Art - - -	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rutherglen - -	Free Church School - -	22	22	6	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tarbat - -	Parochial School - -	26	..	..	..	16	..	10	..	..	..	..	..	18	..	..	..	8	..	..	..	..	..	..	18
						IRELAND.																			
Anahilt - -	Endowed Free School -	20	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	19	..	..	..
Antrim - -	Male National School - } Main Street „ - }	84	..	..	..	10	..	..	..	30	30	..	..	16	..	40	..	..	..	..	..	..	..	..	12
Athlone - -	St. Mary's Parochial School	42	..	..	..	14	..	..	..	30	30	..	..	42	..	42	..	..	..	..	..	..	..	..	..
„ - -	Ranelagh School - -	32	..	..	..	30	..	21	..	25	26	..	..	..	..	..	..	..	..	..	..	21	..	..	32
Bagenalstown -	School-room - - -	40	9	..	..	24	9	9	..	9	40	9	..	..	..	..	..	..	..	..	..	9	9	..	9
Ballieboro' - -	Model School - - -	120	..	..	..	..	..	..	..	..	120	..	..	..	..	..	..	..	..	..	..	..	..	..	120

Ballybay	National School	12	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballyblack	School-room	12	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballycarry	National School	13	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11	..	..	..
Ballykinlar	National School	50	..	..	..	..	..	..	..	50	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballymena	Model School	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	24
"	Guy's National School	15	..	..	..	..	..	..	..	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballymoney	Town Hall	38	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	38
Ballynahinch	Town Hall	29	..	..	..	..	..	..	..	29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	National School	12	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10
Ballywalter	Park School	40	..	..	..	..	..	..	..	..	40	..	..	40	..	..	..	..	..	..	..	..	..	..	..
Ballywilly	National School	20	..	..	..	12	..	..	..	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	16
Banbridge	Scarva Street National School.	21	..	..	..	9	..	..	..	6	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bangor	Endowed School	29	..	..	..	..	..	..	..	29	26	..	..	..	..	29	..	..	..	..	..	..	..	..	..
Belfast	Fisherwick Place School	74	..	..	..	30	..	8	..	12	14	..	..	..	..	..	..	..	..	..	..	..	..	..	50
"	St. George's School	30	..	..	..	..	..	..	..	..	..	..	..	15	..	..	..	12	..	..	..	..	..	..	14
"	Milford Street National School.	16	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10
"	May Street National School	23	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	15
"	Northumberland Street National School.	10	..	..	..	5	..	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Union Place National School	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	70, Albert Bridge Road	10	..	10	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Conway Street National School.	24	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Model School	95	22	22	22	17	..	..	..	73	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Academy St., No. 1, Nat. Sch.	22	..	..	..	..	..	..	..	22	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	" No. 2, "	16	..	..	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..
"	Smithfield National School	12	..	..	..	11	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Glentilt Place	19	..	..	..	..	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..	..
"	Brown Street National School.	60	..	..	..	..	..	..	..	..	39	..	..	..	..	..	..	..	..	..	..	..	..	..	47
"	Nelson Street "	13	..	..	..	8	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	People's Literary Institute	83	25	25	25	52	..	9	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bessbrook	School-house	14	..	..	..	14	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Braidwater	National School	15	..	..	..	..	..	6	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Brookfield	Agricultural School	23	..	..	..	..	..	..	..	..	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Broughshane	National School	20	..	..	..	..	..	..	..	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Caledon	School-house	15	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Carlow	Christian Schools	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Carrickfergus	Model School	43	28	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Carrowdore	National School	48	..	..	..	..	..	..	..	..	48	..	..	..	..	..	..	..	..	..	..	12	5	..	40
Castlederg	Edwards' School, &c.	24	..	..	..	24	..	..	..	..	..	..	..	48	..	..	..	..	..	..	..	..	..	..	43
Castlefin	National School	6	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Clohanbeg	National School	6	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Clonakilty	National School	8	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Clonoore	National School	8	..	..	..	8	..	..	..	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..	8
Coleraine	Model School	30	..	..	..	22	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Comber	Smyth's National School																								
„	No. 1, National School	82	..	..	..	..	..	..	..	..	25	..	..	20	..	30	..	..	..	..	..	..	..	..	15
„	Lisbarnet National School																								
Cooraclare	National School	38	..	..	..	28	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	36
Cork	District Model School	69	..	..	..	14	..	12	..	21	40	..	..	..	..	..	25	..	..	..	..	..	..	..	46
„	Carmichael Schools	70	..	..	..	34	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	53
Cormeen	National School	12	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Crebilly	National School	5	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dartreyhouse	National School	30	..	..	..	6	..	..	..	30	30	..	..	..	..	30	..	..	..	..	..	..	..	..	30
Derrylin	National School	11	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Donaghadee	National School-house	15	..	..	..	10	..	..	..	15	15	..	..	..	..	15	..	..	..	..	..	..	..	..	..
Donegal	National School	14	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Donoughmore	Presbyterian Lecture Room	16	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Downpatrick	Young Men's Christian Association.	18	..	..	..	..	..	..	..	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	John Street National School	53	..	..	..	24	..	..	..	40	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Drogheda	St. Mary's National School	20	..	..	..	6	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..
Drumlough	National School	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Dublin	Central Model School	181	23	8	9	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	161
„	King's Hospital School	46	..	..	..	46	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	24	..	..	46
„	55, Aungier Street	20	..	..	..	20	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Dundalk	Free Library																								
„	Quay Street School	63	22	..	..	43	..	21	..	23	23	26	..	..	..	..	..	..	..	..	..	..	..	..	43
„	Educational Institute																								
„	Jocelyn Street School																								
Dungannon	Erasmus Smith's School	28	..	..	..	8	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20

Eglish	National School	20	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	20
Enniscorthy	Model School	27	..	..	..	16	..	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	13
Enniskillen	Town Hall	13	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Model School	50	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Galgorm	National School	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Galway	Model School	40	..	..	..	..	..	..	..	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gilford	National School	49	..	..	..	..	..	..	..	..	40	..	..	..	..	..	..	..	..	..	..	..	..	..
Greyabbey	National School	48	..	..	..	35	..	..	..	..	43	..	..	..	..	..	..	..	..	..	..	..	..	..
Holywood	Sullivan's Schools & Academy	100	..	..	..	8	..	7	..	20	70	..	..	..	..	60	..	..	..	..	..	..	..	60
Irvinestown	National School	13	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13
Kilkee	National School	41	..	..	..	41	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kilkenny	Model School	42	..	..	..	12	..	..	..	..	41	..	..	..	..	..	..	..	..	..	..	..	..	..
Killylea	School-house	20	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..
Kilmore	Kilmore School	14	..	..	..	12	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	12
Kircubbin	National School	14	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..
Larne	Model Agricultural School	22	..	..	..	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	22	..	..	..
"	North End National School	24	..	..	..	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	24	..	..	..
Letterkenny	National School	25	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ligoniel	Wolfhill Mill	23	..	..	..	8	..	..	..	7	23	..	..	..	..	..	..	..	..	..	..	..	..	..
Lisbellaw	National School	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lisded	National School	16	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16
Lisnagry	Ahane National School	14	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lough Cutra	National School	6	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Loughgall	School-room	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15
Lurgan	National School																							
"	Mechanics' Institute	99	..	..	..	14	..	..	..	..	92	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Model School																							
Magherally	National School	10	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Manorhamilton	Mutual Impr. Assoc. Rooms	30	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Market-hill	Coolmalish National School	24	..	..	..	12	..	..	..	24	24	..	..	..	..	..	..	..	..	..	..	..	..	20
Monaghan	Model School	103	..	..	..	71	..	..	..	..	84	..	..	..	..	..	..	..	..	..	..	..	..	42
Moneyrea	National School	15	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Newry	Model School	10	..	7	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Newtownards	Model School	106	..	..	..	60	..	..	..	90	70	..	..	..	..	..	80	..	..	..	..	..	..	..
"	East Street National School	30	..	..	..	..	..	..	..	..	30	..	..	30	..	..	..	..	..	..	..	..	..	..
"	16, Regent Street	18	..	..	..	..	..	..	..	..	18	..	..	18	..	..	..	..	..	..	..	..	..	..
Newtonbreda	National School	29	..	..	..	..	..	..	..	..	29	..	..	..	..	..	..	..	..	..	..	..	..	..
Oldcastle	Endowed School	165	..	..	..	45	..	..	..	..	90	..	..	..	..	..	..	..	..	..	..	..	..	75

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Omagh - -	Model School - - -	42	..	..	..	42	..	..	..	42	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Parsonstown -	Model School - - -	24	..	..	..	19	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..	6	..	..	23
Portadown - -	Town Hall - - -	30	..	..	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	..	..	..	..	..	30
„ -	Edenderry National School -	16	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Raphoe - -	National School - -	6	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	Court House - - -	10	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rathfryland - -	Town Hall - - -	13	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Roscrea - -	National School - -	30	..	..	..	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	29
Rosscarbery - -	Mount Fachnanus National School.	40	..	..	..	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Santry - -	Training School - -	72	40	..	..	40	13	13	..	40	40	40	..	..	..	..	..	..	40	..	..	13	13	..	40
Scariff - -	National School - -	27	..	..	..	13	..	..	..	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sixmilecross -	National School - -	15	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stewartstown -	School-room - - -	40	..	..	..	..	..	..	..	..	40	..	..	..	..	..	..	..	..	..	..	..	..	..	40
Tandragee - -	Duke's School - -	15	..	..	..	..	..	..	..	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Trim - -	Model School - - -	30	..	..	..	..	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..
Tullynamullen -	National School - -	9	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Waterford - -	Model School - - -	55	..	..	..	..	..	..	..	..	..	55	..	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	Newtown School - - } Leper Hospital - - }	43	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	43	1	..	..	..	..	..	..
	Total Number of Classes	1,456	158	158	129	153	5	58	16	93	132	152	25	41	8	129	15	19	9	8	13	22	12	5	111
	„ „ Students	21,590	4,465	4,416	3,632	3601	33	1124	338	2305	4076	4384	981	967	159	3500	452	283	226	79	248	1165	951	128	3548

517 Schools.

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LONDON:
Printed by George E. Eyre and William Spottiswoode,
Printers to the Queen's most Excellent Majesty.
For Her Majesty's Stationery Office.
[6222.—2000.—9/69.]

SCIENCE AND ART DEPARTMENT
OF THE COMMITTEE OF COUNCIL ON EDUCATION,
SOUTH KENSINGTON.

DIRECTORY,

(*Revised to February* 1870.)

21st EDITION.

WITH

REGULATIONS

FOR

ESTABLISHING AND CONDUCTING

SCIENCE SCHOOLS & CLASSES.

THE RULES IN THE PRESENT EDITION SUPERSEDE THOSE IN ALL FORMER EDITIONS,
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SOLD BY CHAPMAN AND HALL,
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1870.

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INTRODUCTION.

The following introduction gives a general outline of the action of the Department, and has been prepared to enable those who wish to establish a Science School or Class the more readily to understand the detailed rules and regulations under which the aid of the Department is administered.

Local committees.

1. In order to place a Science school or class in connexion with the Science and Art Department, an approved committee, consisting of at least five well-known and responsible persons must be formed. (*See* Science Directory, §§ X. to XVI., pp. 4 to 6.)

Subjects of instruction.

2. The list of Science subjects towards instruction in which aid is given by the Department will be found at p. 3.

Nature of aid.

3. The aid is given in the form of—Public examinations, in which Queen's Medals and Queen's Prizes are awarded, held at all places complying with certain conditions; payments on results as tested by these examinations; scholarships and exhibitions; building grants; grants towards the purchase of apparatus, &c.

Examinations, when and how held.

4. The Examinations are held about the month of May under the superintendence of the local committees. The examination papers are prepared by the professional examiners in London. An evening is set apart for one or more subjects, so that the examination in each subject is simultaneous over the whole kingdom. (*See* Science Directory, § XVIII., p. 7.)

Examination papers how sent and worked.

5. A packet of Examination papers is sent to each local secretary, who opens it in the presence of the committee and candidates. The committee is held responsible that no unfair means of any description are used in working the papers, and that the rules of the Department are strictly complied with. (*See* Science Directory, § XXII., p. 8, and Appendix A., Science Form No. 91, p. 38.)

Class examinations.

6. The examinations are of two kinds, but held together (*See* Science Directory, § XVIII., p. 7), viz.:

a. The class examinations, of which there are two grades or stages; the first stage or elementary examination, and the second stage or advanced examination. The successful candidates in both stages are divided into 1st and 2nd class.

For Honours.

b. The honours examination of a highly advanced character. In this there are also two classes.

Any person however taught may sit at any one of these examinations. (*See* Science Directory, § XXVIII., p. 10.)

Medals.

7. Four medals, one gold, one silver, and two bronze, are given in each subject in competition in the class examinations among the students. (*See* Science Directory, § XXXI., p. 11.)

Prizes.

8. Queen's prizes consisting of books or instruments are also given to all candidates successful in obtaining a first class in either stage of the class examinations. (*See* Science Directory, § XXIX., p. 10.)

Payments on Results.

9. Payments are made either to the Committees or to the Teachers on the results of the May examination.

Amount and conditions of payment.

10. These payments are made only on account of the instruction of students of the industrial classes, or on account of the instruction of their children. (For a definition of the Industrial Classes *see* Science Directory, § XXXVI., p. 13.) They are—2*l.* for a first class, and 1*l.* for a second class, in each stage. (*See* Science Directory, §§ XXXVII. and XXXVIII., p. 13.) In certain cases payments are also made for "honours." The teacher must have given each student 25 lessons at least. (*See* Science Directory, § XXXV., p. 12.)

Qualification.

11. Any person may qualify himself or herself to earn payments on results, by obtaining a first or second class in the advanced grade of the class examination, or by taking honours.

This examination is dispensed with when the candidate has taken a degree at one of the Universities of the United Kingdom. (*See* Science Directory, § XXXIII., p. 12.)

12. To assist in the instruction of deserving students, aid is given in the creation of two forms of scholarship in connexion with elementary schools. **Scholarships.**

a. In the *Elementary School Scholarship* 5*l.* are granted to the managers of any elementary school for the support of a deserving pupil selected by competition, if they undertake to support him for a year and subscribe 5*l.* for that purpose. The payment of 5*l.* by the Science and Art Department is conditional on the scholar passing in some branch of science at the next May examination. (*See* Science Directory, §§ XLVII. and XLIX., p. 17.) **Elementary school scholarship.**

b. In the *Science and Art Scholarship*, which is of a more advanced character, a similar contribution of 5*l.* is required on the part of the locality, and a grant of 10*l.* is made by the Department towards the maintenance, for one year, of the most deserving pupil or pupils in elementary schools who have passed certain examinations in science and in drawing. (*See* Science Directory, §§ XLVII. and L., pp. 17 and 18.) **Science and Art scholarship.**

In both these cases the scholar must be from 12 to 16 years of age, and one scholarship is allowed per 100 pupils in the school.

13. There are also two forms of Exhibitions. These are:— **Exhibitions.**

a. *Local Exhibitions* to enable students to complete their education at some college or school where scientific instruction of an advanced character may be obtained. Grants of 25*l.* per annum, for one, two, or three years are made for this purpose when the locality raises a like sum by voluntary subscriptions. And if the student attend a State school, such as the Royal School of Mines in London, the **Local exhibition.**

Royal College of Chemistry in London, or Royal College of Science in Ireland, the fees are remitted. The exhibition must be awarded in competition. (*See* Science Directory, §§ LII. and LIII., p. 19.)

Royal exhibition.

b. *Royal Exhibitions* of the value of 50*l.* per annum tenable for three years, to the Royal School of Mines, London, and the Royal College of Science, Dublin, are given in competition at the May examinations. Six are awarded each year—three to each institution. Free admissions are also given to all gold medallists. (*See* Science Directory, §§ LII., LIV., LV., pp. 19 to 21.)

Whitworth Scholarships.

14. Besides these, the *Whitworth Scholarships* of the value of 100*l.* per annum, tenable for two or three years, are also given in competition at the May examinations. (*See* Science Directory, § LVI., p. 21.)

Building grant.

15. A grant in aid of a new building, or for the adaptation of an existing building, for a School of Science may be made at a rate not exceeding 2*s.* 6*d.* per square foot of internal area, up to a maximum of 500*l.* for any one school, provided that certain conditions are complied with and that the school be built under the Public Libraries and Museums Act, or be built in connexion with a School of Art, aided by a Department building grant. (*See* Science Directory, § LVII., p. 21.)

Apparatus grant.

16. A grant towards the purchase of apparatus, diagrams, &c., of 50 per cent. of the cost of them is made to Science Schools. (*See* Science Directory, §§ LVIII. to LXIII., pp. 22 and 23.)

SCIENCE DIRECTORY,

Revised to Feb. 1870.

Showing the NATURE and AMOUNT of ASSISTANCE afforded by and through the SCIENCE AND ART DEPARTMENT to INSTRUCTION in SCIENCE.

[The Rules in the present Edition supersede those in all former Editions, but are always subject to Revision. *Important Alterations made since the last edition of the Directory are printed in Italics.*]

SCIENCE DIRECTORY,

Containing the Detailed Rules and Regulations under which Aid to Science Schools and Classes is administered.

Parliamentary vote.

I. A sum of money is voted annually by Parliament for scientific instruction in the United Kingdom, and is administered by the Science and Art Department.

Heads of the Department.

II. The head of the Education Department, of which the Science and Art Department is a branch, is the Lord President of the Council, assisted by a member of the Privy Council, who is called the Vice-President of the Committee on Education, and who acts under the direction of the Lord President, and for him in his absence. (Order in Council, 25th February 1856, Act 19 & 20 Vict. c. 116.)

Object of the grant.

III. The object of the grant is to promote instruction in Science especially among the industrial classes, by affording a limited and partial aid or stimulus towards the founding and maintenance of Science schools and classes.

Grant liable to be withdrawn.

IV. The amount is liable to be decreased and eventually withdrawn. Payments to teachers therefore must not be looked upon as perpetual, or in any way conferring on the teacher a claim to any payments beyond those offered for each current year.

Payment of Fees by Students.

V. The payment of fees by the students can be looked upon as the only solid and sufficient basis on which a self-supporting system can be established and supported. Though my Lords do not consider it necessary at present to lay down any rules making the payment of fees an absolute condition of the grants on account of Science instruction, yet as the payments from the State must be expected to diminish, and as aid on account of those persons who do nothing for themselves cannot be justified, Committees of schools and classes and teachers are

strongly urged (should it at present not be the practice) at once to impose as high a scale of fees as they consider can be raised not only on middle class students but also on artisans.

VI. The following are the Sciences towards instruction in which aid is given :— List of Science subjects.

Subject 1, Practical Plane and Solid Geometry.
„ 2, Machine Construction and Drawing.
„ 3, Building Construction *or* Naval Architecture and Drawing.
„ 4, } Pure Mathematics.
„ 5, }
„ 6, Theoretical Mechanics.
„ 7, Applied Mechanics.
„ 8, Acoustics, Light, and Heat.
„ 9, Magnetism and Electricity.
„ 10, Inorganic Chemistry.
„ 11, Organic Chemistry.
„ 12, Geology.
„ 13, Mineralogy.
„ 14, Animal Physiology.
„ 15, Zoology.*
„ 16, Vegetable Anatomy and Physiology.
„ 17, Systematic and Economic Botany.
„ 18, Principles of Mining.
„ 19, Metallurgy.
„ 20, Navigation.
„ 21, Nautical Astronomy.
„ 22, Steam.
„ 23, Physical Geography.

VII. The assistance granted by the Science and Art Department is in the form of— Nature of assistance.

1. Public examinations, in which Queen's Medals and Queen's Prizes are awarded, held at all places complying with certain conditions.
2. Payments on results to Committees or teachers.
3. Scholarships and Exhibitions.

* No candidate will be passed in Zoology unless at the same or at a previous examination he has passed in the elementary stage of Animal Physiology.
(*ppendix B.*, p. 99.)

4. Building Grants.
5. Grants towards the purchase of apparatus, &c.
6. Supplementary grants in certain subjects, and special aid to teachers and students.

NOTE.—*As respects all grants and awards, the Department will be the sole judge, and cannot enter into correspondence respecting its decisions.*

School Premises.

VIII. Suitable premises, with firing, lighting, &c., must be found and maintained at the cost of the locality where the school or class is held. If at any time the funds do not cover these requisite local expenses, it must be inferred that there is no such demand for instruction in the locality as the Government is justified in aiding; and the assistance of the Department will be withdrawn.

IX. A school or class receiving aid from the Science and Art Department must be at all times open to the visit and inspection of its officers.

Constitution of Local Committee.

X. Every Science School or Class must be under the management of a Local Committee who are required to be responsible for the safe custody of all apparatus, towards the purchase of which the Department has granted aid, and to conduct the examinations according to the rules. (*See* Appendix A., Science Form No. 91, p. 38.)

The relation of the teacher to the Committee of a school or class will vary much according to the varying circumstances of different localities. With this and other local arrangements the Science and Art Department does not interfere, but leaves them to the locality to settle.

a. The Committee must consist of a Chairman, Secretary, and at least three other members, and must be composed entirely of well-known responsible persons of independent position who have no such personal interest in the school or class as can lay them open to the slightest suspicion of partiality. Relations and pupils of the Teacher, persons under instruction in any school or class receiving aid from the Science and Art Department, and teachers of any description having pupils

who are candidates for the examinations of the Department, are not eligible as members of the Committee.

NOTE.—A gentleman whose son attends any examination of the Science and Art Department is thereby disqualified from superintending any of the examinations that year, though he may act on the Committee in other respects.

b. It is very desirable that as many persons as possible in recognised positions of public responsibility in the district, such as magistrates, municipal authorities (mayor, aldermen, or town councillors), heads of educational establishments (trustees of grammar schools, managers of National schools), clergymen, &c., should be on the Committee, and it is ***absolutely necessary*** that at least two such responsible persons should agree to act.

c. The Chairman must be a magistrate, mayor, boroughreeve, provost, alderman, or other public officer of recognised position; trustee of grammar school, clergyman of the Established Church in parochial employment, or minister of religion in charge of a licensed place of public worship. He will have to certify that the constitution of the Committee is in accordance with the above requirements. (*See* Appendix A., Science Form No. 88, p. 29.)

d. The Secretary of the Committee of the School or Class, as being the medium of communication, will carry on all correspondence with the Science and Art Department, and is held responsible for making out and sending all returns required, for the receipt and distribution of the examination papers, the transmission of the worked papers, &c., at the proper times according to the regulations.

Formation of Local Committee.

XI. The gentlemen who intend to act on this Committee must sign their names to a form (*write for* Science Forms Nos. 88 and 120), stating their willingness to carry out the necessary arrangements for examinations, and to observe all the regulations of the Department; each member after signing must also give his address and occupation. Care must be taken that the members who sign are properly acquainted with the duties they propose to discharge.

When a school or class is first formed, the Form No. 88 must be signed at a general meeting of the Committee. If the same Committee continue to act it will only be necessary to fill up Form No. 168, which expresses the willingness of the members to undertake their duties for another year; ***but no one can be a member of a Committee nor assist in the conduct of an examination who has not signed Form No.*** 88.

Approval of, by the Department.

XII. As soon as a school or class has been established and the Committee formed, application must be made that it may be approved by the Department (*send up* Science Forms Nos. 88 and 120). No payments on account of instruction will be made unless this approval has been obtained before the 31st January preceding the examination.

N.B.—The school and class registers (see § XLIII., *p.* 15) *will not be sent until these forms, properly filled up, have been received from the school applying for them.*

Committee for conducting an examination only.

XIII. A Committee may be formed for conducting the examination only of a class or school which does not receive aid from the Department in the form of payments on results. It must be approved before the 31st March (*write for* Science Form No. 88*a*).

Reimbursement of Committee.

XIV. For the clerical labour of making the necessary returns, filling up forms, &c., a grant is made to the Committee of 1*l*. This is paid after the conclusion of the examinations.

When more than two examinations are held, the sum of 10*s*. will be allowed to the Committee—or in the case of an amalgamation (*see* § XXV., p. 9), to the amalgamated Committee—for each further examination for the expenses connected with it.

These grants will only be made provided the examinations are regularly conducted, and the returns and forms sent up in due course, as given on the Science Form No. 170. (See *Appendix A., p.* 28.)

Inspection.

XV. As often as may be necessary an Inspector of the Department will visit the school or class, and report on the condition of the premises, the constitution of the Committee, and the manner in which the regulations are carried out.

If due notice of the visit of the Inspector has been given, a meeting of the Committee must be held to receive him, at which as many of the members as possible are expected to attend. (*See* Science Form No. 170, *Appendix A.*, p. 28.)

Memoranda for Secretaries.

XVI. At page 28 in the Appendix will be found a table of memoranda for the use of Secretaries and

Members of Science Committees (*write for* Science Form No. 170) *which it is expected will be carefully attended to.*

Examinations.

XVII. The Science and Art Department holds annually about May, through the agency of the Local Committees, public examinations in all the before-mentioned Sciences in any place in the United Kingdom which complies with the requisite conditions. (*See* §§ X. to XIII., p. 5.) On the results of this examination payments are made for the instruction of the students, and medals and prizes are awarded. **Examination of Classes.**

For Navigation Classes special examinations are also held three times a year. (*See* § LXIV., p. 24.)

XVIII. The examinations are of two kinds, but are held on the same evening and conducted by the same Committee:— **Examinations, how held.**

a. The class examinations for students under instruction in Science Classes whether taught by teachers qualified to earn payments on results or not.

b. The honours examination, of a highly advanced character.

XIX. For the purpose of the class examinations each subject is divided into two stages—the elementary and the advanced stage; *except Mathematics, which is divided into seven stages* (*see* Syllabus, p. 54). There is a different examination paper for each stage, and in each stage there are two grades of success—first and second class. For the second or lowest class of the elementary stage, the standard of attainment required is only such as will justify the Examiner in reporting that the instruction has been sound, and that the students have benefited by it; but the standard may be raised from year to year. **Classification of Results of examinations.**

Class examination in Mathematics.

XX. *In Mathematics the examination in stages* 1, 2, *and* 3 *is held on one evening; in* 4 *and* 5 *on another; and in* 6 *and* 7 *on another. A student can only take up the examination in one stage on one evening.*

Honours paper.

XXI. There is an honours paper in each subject, *except Mathematics, which for this purpose may be considered as divided into three subjects, an honours paper being set on each evening for the whole of the stages comprised in that evening's examination.*

Application for Examination.

XXII. An application, stating in what subjects examination will be required, must be made on Science Form No. 329, *and sent in before the* 28*th of February. A second form (Science Form No.* 119) *must be sent in before the* 31*st of March, giving the precise number of candidates to be examined in each subject.*

On the 31*st of March the examination lists must be finally closed, and unless these instructions have been* **strictly** *adhered to no examination can be held.*

The rules for the conduct of the examinations will be found on Science Form No. 91 (*see* Appendix A., *p.* 38). *They must be carried out with the utmost strictness.*

Re-examination.

XXIII. Should there be at any time reason to suspect the fairness of the examination generally, or of the way in which particular candidates have worked their papers, a further examination will take place in such manner as may be deemed most advisable. Refusal on the part of any candidate to be re-examined will entail the cancelling of his previous examination.

Department not responsible for errors.

XXIV. All possible care will be taken by the Department at the time of the examinations that papers shall be forwarded in accordance with the applications, and that the results may be correctly issued. As, however, a very large number of classes have to be dealt with, mistakes may possibly occur. The Department cannot undertake to rectify such

mistakes, nor will it hold itself responsible for any loss which may in consequence accrue to individual committees, teachers, or students.

XXV. If two or more classes in the same town, or within a reasonable distance of one another, apply for the examination of the Science and Art Department, a general examination committee must be formed by the amalgamation of the several Committees to carry out the examinations at some common centre, such as the town hall or other public building. It is only when the Inspector reports that the local circumstances are of such a character as to render an amalgamation of the Committees impracticable that it will not be insisted on. **Amalgamation of Classes and Committees.**

When there are not more than three candidates in one place, it will be at the discretion of the Department to allow a separate examination, or to require the candidates to go to a neighbouring centre.

XXVI. In large towns or populous districts where there are three or more schools, and where numerous examinations are to be held, the Science and Art Department may at its discretion require a Special Local Secretary to be appointed to manage the whole of the examination business. The Department will correspond with him alone on all subjects connected with the examination. He will be allowed a fee of ten guineas, and an extra fee of half a guinea for each night that an examination is held. **Special Local Secretary.**

The rule requiring an amalgamated examination to be held in some one public building (*see* § XXV.) will be adhered to also in this case. Even where no sufficiently large public building can be obtained, or where there may be other insuperable difficulties to holding the examinations at one centre, the one Special Local Secretary must still be the one medium of communication with the Department, and will be responsible for all arrangements subject to the approval of the Science and Art Department.

XXVII. The election of the Special Local Secretary will rest with the Local Committees; or failing their coming to an agreement he will be nominated by the Mayor or other principal municipal authority. **Election of Special Local Secretary.**

The Special Local Secretary must be nominated for the approval of the Science and Art Department from year to year, before the 15th of March.

Examination of external Students.

XXVIII. Besides the registered students of a class, any other person may present himself for examination before the Local Committee whenever an examination is being held for the class. *Before the 26th of March he must apply to a Local Secretary, who will forward his name to the Department on Science Form No.* 119, and if required by the Local Committee he will have to pay a registration fee of not more than 2*s*. 6*d*. Arrangements must therefore be made by the Local Committee, or the General Examination Committee, as the case may be, to give accommodation at the examination to all outside candidates *who have given the proper notice*, as well as to the students in the class for which the Committee act, to sit at the examination.

The registration fee of 2*s*. 6*d*., which such candidates may be required to pay, is to reimburse the Committee for any extra expenses incurred by such attendance, and may at their option be reduced or remitted.

Queen's Prizes.

XXIX. To all successful students are given printed lists of results showing their position; to the first class in each stage are given Queen's prizes, consisting of books or instruments chosen by the candidates from lists furnished for that purpose. (*Apply for* Science Form No. 110.)

No Queen's prize or medal will be given to a student in the advanced stage unless he have previously passed in the elementary stage, or been successful under the old system.

Candidates eligible for Prizes.

XXX. The prizes are unlimited in number, and are open to all candidates who come within either of the following categories:—

(1) Students in Science Classes under Teachers qualified to earn payment.

(2) Registered Students in Artisan Classes taught by other Teachers.

The following are not eligible for prizes:—

a. Students who have previously received the same, or a higher class, in the same subject; and

b. Teachers earning or who have earned payments on the results of instruction. Also

c. Persons who are or have been students of the Queen's Colleges in Ireland, the Royal School of Mines, London, the Royal College of Science, Dublin, the Royal Dockyard Schools, and other institutions receiving State aid for instruction may compete for the Whitworth and other Exhibitions and Scholarships of the Department, but they cannot take Queen's prizes and medals, except in those subjects which are not taught *as a portion of the regular course* in the Institutions to which they belong.

XXXI. Four medals, one gold, one silver, and two bronze, are *given in the class examination* in each subject for competition among the bonâ fide students of Science Classes who either come within the category of persons on account of whom payments can be earned, or are under 17 years of age. Queen's Medals.

Only registered students of schools and classes under Local Committees (*see* § X., p. 4) can take medals: middle class students, persons engaged in teaching, as well as *teachers in training*, who are more than 17 years of age, even if qualified as above, are ineligible for them. Should a student take more than one gold, silver, or bronze medal, he will receive books instead.

Payments on Results.

XXXII. Payments are made on the results of instruction when it has been given by teachers who have qualified in either of the categories mentioned below: And no payments are made on account of instruction given in subjects in which the teacher is not so qualified. Qualification for earning payments on results.

The qualification consists in having—

a. obtained a teacher's certificate in any of the before-mentioned sciences according to the rules in force previous to January 1867; or,

b. obtained a First or Second Class in the advanced stage at the May class examinations since that date; or,

c. taken honours at the May examination.

In Mathematics a First Class in each stage will from and after May 1870 *qualify the holder to earn payments on the results of instruction in that stage,*

and a First Class or Honours in stages 3, 5, and 7, on the results of instruction in the preceding stages.

Teachers already qualified to earn payments in "Elementary Mathematics" are qualified in stages 1, 2, and 3, and teachers already qualified in "Higher Mathematics" are qualified in all the stages of Pure Mathematics.

Honorary and 3rd grade Art Certificates.

XXXIII. The examination for qualification to earn payments on results of instruction will be dispensed with in the case of a candidate who has taken a degree at any University of the United Kingdom, or who has obtained the Associateship of the Royal School of Mines, London, or the Royal College of Science, Ireland.

Before such a candidate *commences to teach, in order to earn payment on results,* he must make formal application to the Department to be recognised as a Science teacher, and he must furnish full particulars of his occupation and position accompanied by his diploma or a certificate from the registrar of his University.

Teachers who previously to the 28th January 1869 have obtained Art certificates of the third grade are also qualified without further examination to earn payments on the results of their instruction in subjects I., II., and III., under the same rules and on the same conditious precisely as Science teachers. *It must be clearly understood that to claim these payments the rules of the* **Science Directory** *must be adhered to.*

Payments to whom made.

XXXIV. Payments on results are made at the discretion of the Department either directly to teachers or to the Committee or managers of the school.

Conditions.

XXXV. Payments are only made to the teacher or to the Committee on condition that the student has received 25 lessons at least from the teacher or teachers in each subject in which payment is claimed since the last examination, each lesson being an attendance at a meeting of the school of at least three-quarters of an hour's duration on a separate day. The 25 lessons need not necessarily be all given in one year, but may extend over a longer period.

It must be clearly understood that the number (25) of lessons which the teacher is required to give is the minimum fixed as a criterion that the pupil has received his instruction from the teacher. It is not meant in any way to specify that that amount of instruction is sufficient, or to guarantee the teacher's receiving payment, if that amount of instruction alone is given.

XXXVI. Payments are made to the qualified teacher ou account of the instruction of students of the Industrial Classes only. Payments made for instruction of Industrial Classes.

Under "Students of the Industrial Classes" are included only :— Definition of Industrial Classes.

a. Artisans or operatives in the receipt of weekly wages.

b. Coastguards, policemen, and others who, though in receipt of weekly wages, do not support themselves by manual labour.

c. Persons in the receipt of salaries not large enough to render them liable to the income tax, as some descriptions of clerks, shopmen, &c.

d. Small shopkeepers employing no one but members of their own family and not assessed to the income tax.

e. Tradesmen and manufacturers on their own account, supporting themselves by their own manual labour, not employing apprentices, journeymen, &c., and not assessed to the income tax.

f. The children (not gaining their own livelihood) of all such persons above mentioned.

XXXVII. The payments claimable for each student who has passed in either stage, in each subject are—2l. for a first class, and 1l. for a second class. But no payments are made on account of a student who has been previously successful in a higher stage of the same subject. *Payments claimable on the results of the Class Examinations.*

If the student has been previously successful in the same stage of the same subject, the payment on his account is reduced by the payment which was claimable on such previous success.

For instance, the 2l. payment for a first class would, if the student had previously taken a second class in the same stage, be reduced by 1l.

Deductions are also made in payments on account of Subject I. to the amount of any payments that have been made on the Second Grade Examinations in Art, in Practical Geometry, Perspective or Mechanical Drawing.

XXXVIII. On each student who passes in the First or Second class in Honours 4l. and 2l. respectively are claimable, provided the student has already passed through the elementary and advanced stages after instruction in a Science Class in connexion with the Department. *Payments claimable on the results of the Honours Examinations.*

Payments claimable on Candidates previously successful.

XXXIX. Payments will be made on the results of the May 1870 *examination on the following scale in the case of pupils who have been successful at the examination in May* 1869 *or at any previous examinations in the elementary stage of the same subject (except as respects Mathematics, for which see next Rule):—*

*a. For a first class in the elementary stage—the student having previously obtained a third class—*1*l.* 10*s.*

*b. For a first class—the pupil having previously obtained a second class—*1*l.*

*c. For a second class—the pupil having previously obtained a third class—*10*s.*

XL. As respects Mathematics (Subjects IV. and V.) the arrangements with regard to the previous successes of students will be understood from the following table. The corresponding divisions of the subject under the old and new systems are given in the columns A. and B. With a previous success, therefore, as given in column A., no payment will be made on account of the corresponding success at the May 1870 *examination, as given in column B.*

A.	B.
Elementary Mathematics, IV.	*Pure Mathematics.*
3rd *Class, First Stage*	*Stage* 1.
2nd " "	*do. and* 2nd *Class of Stage* 2.*
1st " "	*do. and Stage* 2.
2nd " *Second Stage*	*Stages* 1 *and* 2.
1st " "	*do. do. and* 2nd *Class of Stage* 3.
Higher Mathematics, V.	
3rd *Class, First Stage*	*Stages* 1, 2, *and* 3.
2nd " "	*do. do. and* 2nd *Class in Stage* 5.
1st " "	*do. do. and* 2nd *Class in Stage* 6.
2nd " *Second Stage*	*Stages* 1, 2, 3, *and* 6, *and* 2nd *Class in Stage* 5.
1st " "	*do.* 1, 2, 3, 5, 6, *and* 2nd *Class in Stage* 7.

* If a student passes in the First Class of the Second Stage, the teacher will then receive 1*l.* on his amount.

XLI. The Rule which makes the payments not cumulative in the two stages of a subject is not applied—except as regards Mathematics—in the case of Students who, in May 1870, *are* bonâ fide *passing for, and intend at once to become, Science Teachers. The payments, if they pass in the First or Second Class of the Advanced Stage, will be* 4*l.* *and* 3*l. respectively.* **Payments on Students intending to become Teachers.**

Teachers who propose to bring up pupils and to claim under this exemption must apply on Science Form No.* 364A., *not later than the* 28*th February, so that their cases may be considered. No claim will be admitted unless this rule has been complied with.

XLII. The claim for the payments must be made on Science Form No. 51. The voucher must be signed by the secretary or chairman and two members of the Committee at least, at a meeting of the Committee held specially for the examination and certification of the claim. (*See* Science Form No. 51, Appendix A., page 35.) *N.B.—Many details with regard to payments will be understood from the cases given in this form.* **Form of Claim for Payment.**

XLIII. A general register must be kept for the school, and an attendance register for each class in each subject, on Forms which will be supplied on application. (*Apply for* Science Forms Nos. 139 and 139A.) These registers must be made up from day to day, and will be examined and approved by the Inspector on his visit. They must be sent to the Department with the claim for payment, and no grants will be made unless the registers are properly kept. **Registers.**

a. The Committee must keep a General Register (Science Form No. 139) of all the pupils attending the Science Classes under their supervision, in which the name, age, address, and occupation of each student must be entered. This register must be filled in by the Secretary or a member of the Committee, and not by the teacher.

b. For every class the teacher must keep a register of attendance (Science Form No. 139A), in which he will enter the presence or absence of the students at each lesson. The Committee is held responsible for the entries being correct.

c. A register must also be kept of the attendance of the members of the Committee at their different meetings. (*See* page 8 of Science Form No. 139.)

Instruction in an Elementary School.

XLIV. All payments to qualified teachers on account of Science teaching are made by the Science and Art Department, and are only made in respect of a school in connexion with the Science and Art Department. No such payments are made in respect of any instruction in Science that may be given during the three attendances of an Elementary School receiving aid from the Educational Department, Whitehall.

Use of Elementary School premises.

These grants are only made while the teacher is giving instruction in a day or evening school or class for the industrial classes (adults or boys), approved by the Science and Art Department, and open at any time to the visit and inspection of its officers. The managers of an Elementary School under the inspection of the Education Department can permit their premises to be used for Science teaching, provided that no interference be allowed with the primary purposes of such Elementary School, or in any way with the three attendances of the Elementary School.

Instruction in Institutions receiving State aid.

XLV. No payments on the results of instruction in those branches of Science which are taught in Institutions receiving State Grants, such as the Queen's Colleges in Ireland, the Royal School of Mines, London, the Royal College of Science, Dublin, and the Royal Dockyard Schools, will be made on account of the pupils who are or have been students of those institutions.

No payments are made on account of students passing in Stage 1 *of Mathematics who are,—*

a. Students in Training Colleges receiving State aid.

b. Teachers trained at the public expense.

Examination by the Inspector.

XLVI. On the occasion of his periodical visit to the school or class, the Inspector will inquire and see how the instruction is being given, examining the pupils, if necessary, *vivâ voce*, and report if there is sufficient apparatus for the satisfactory teaching of experimental science. If the Inspector's report of any school shows that the instruction is inefficient, and that from the deficiency of proper apparatus, &c. it cannot be otherwise, the Science and Art Depart-

ment may refuse to make payments on the results of the examinations.

Scholarships and Exhibitions.

XLVII. In order to assist persons belonging to the industrial class who may show an aptitude for scientific instruction, the Science and Art Department makes grants to aid local efforts in founding scholarships and exhibitions. The scholarship is intended to maintain the student while remaining at the elementary school, and the exhibition to support him while pursuing his studies at some central institution where the instruction is of a high grade. **Scholarships and Exhibitions.**

XLVIII. There are two forms of local scholarship in connection with elementary schools:— **Local Scholarships.**

(1.) The Elementary School Scholarship;
(2.) The Science and Art Scholarship.

By elementary school is understood any school where elementary instruction is given, whether aided by the State or not.

XLIX. *Elementary School Scholarship.*—The Science and Art Department will make a grant of 5*l.* towards the maintenance of a deserving student to the managers of any elementary school who undertake to support him for one year and subscribe at least 5*l.* for that purpose. **Elementary School Scholarships.**

Conditions.— **Conditions of obtaining the Elementary School Scholarships.**

a. With any number of scholars up to 100 on the register of the school there can be but one such Scholarship; above 100 and up to 200 two Scholarships, and so on for each 100.

b. The Scholarship or Scholarships must be awarded in competition to the most successful student or students in some examination of the school. The absolute terms of the competition and the award of the Scholarship will be left to the managers of the school, subject to the approval of the Science and Art Department.

c. The scholar must be a student of the industrial class, as defined above (see § XXXVI., p. 13), and be between 12 and 16 years of age.

d. He must not be the teacher, pupil-teacher, or other paid servant of a school.

e. He must continue regularly to attend the day school, and—

f. Obtain *at least a second class* in the elementary stage in some one or more branches of Science at the succeeding May examination of the Science and Art Department, after which the Department grant of 5*l.* will be paid.

Date of application and of grant.

Application must be made for the Elementary School Scholarships before the 1st March in one year, and the Department grant will be paid after the May examination in the next year. (*Apply for* Science Forms Nos. 280, 281, 282.)

Science and Art Scholarship.

L. *The Science and Art Scholarship.* — The Science and Art Department will make a grant of 10*l.* towards the maintenance of a student at an elementary school who has taken a first grade in Freehand or Model Drawing and Elementary Geometry (*see* Art Directory, p. 16), and passed in one of the subjects of Science, provided that the managers of the school undertake to support him for one year and subscribe 5*l.* for that purpose.

The examination in drawing can, where there is no Art Certificated Teacher, be held by the Science Class Committee, to whom the necessary papers will be sent.

Conditions of obtaining the Science and Art Scholarship.

Conditions.—

a. With any number of scholars up to 100 on the register of the school there can be but one such Scholarship; above 100 and up to 200 two Scholarships, and so on for each 100 scholars.

b. The Scholarship or Scholarships will be awarded to the most successful student or students in the school.

c. The scholar must be a student of the industrial class, as defined above (*see* § XXXVI., p. 13), of between 12 and 16 years of age.

d. He must not be the holder of an Elementary School Scholarship, the teacher, pupil-teacher, or other paid servant of a school.

e. He must continue regularly to attend the day school, and—

f. Obtain a higher class in the subject of Science in which he has already passed, or pass in some other subject.

g. In each year of holding the Scholarship he must pass either in a higher grade of the same subject or in a new subject.

Date of application and of grant.

Application for the Science and Art Scholarship must be made before the 1st March in one year; the successful competitors for the scholarship will be decided at the May examinations of that year, and the Department grant of 10*l.* will be paid

after the May examination in the next year. (*Apply for* Science Forms Nos. 283, 284, 285.)

LI. It rests with the local managers of the scholarships—whether "Elementary School" or "Science "and Art"—to determine for how many years the student may hold the scholarship, but in no case can he be allowed to hold it for more than three years. **Renewal of grants for Scholarships.**

LII. For advanced scientific instruction, the Department offers exhibitions to enable students to complete their education at some college or school where scientific instruction of an advanced character may be obtained. These exhibitions are of two kinds:— **Exhibitions.**

(1.) The Local Exhibition.
(2.) The Royal Exhibition.

LIII. *Local Exhibitions.*—The Science and Art Department will make a grant of 25*l.* per annum to the Managers of any school or educational institution, or any Local Committee formed for the purpose, who will raise the like sum by voluntary contribution for the maintenance of a student at some college or school where scientific instruction of an advanced character may be obtained. The exhibition may last for one, two, or three years. **Local Exhibition.**

Conditions.— **Conditions of obtaining it.**

a. The exhibition must be awarded in competition in one or more branches of Science at the May examination of the Science and Art Department. The managers may select any branch or branches of Science for the competition, and if more than one be taken they may fix any relative amount of marks they consider best to assign to them.

b. The place or places where the exhibition is to be tenable and where the student is to pursue his studies may be fixed by the managers subject to the approval of the Science and Art Department, provided that the exhibitioner shall always have the option of going to one of the following institutions:—The Royal School of Mines or Royal College of Chemistry, London, or the Royal College of Science, Dublin. If either of the Government institutions be selected, the fees of the student will be remitted.

c. The exhibitioner must be a student of the industrial class, as defined above (*see* § XXXVI., p. 13).

d. The grant of the Department will be paid from year to year on condition that a like payment has been made by the managers or Local Committee, and that the student has pursued his studies satisfactorily according to regulations fixed by the Department.

Date of application.

The Local Exhibition must be applied for before the 1st March. (*Write for* Science Forms Nos. 286, 287, 288.)

Thus, for example, a Local Exhibition which is to be competed for in May 1875 must be applied for before the 1st March 1875, and the Department grant will be given after the May examinations in 1876.

Royal Exhibitions.

LIV. *Royal Exhibitions*, of the value of 50*l.* per annum tenable for three years, to the Royal School of Mines, London, and the Royal College of Science, Dublin, are given in competition at the May examinations.

Competition for and conditions of holding them.

There are nine Royal Exhibitions to the Royal School of Mines, Jermyn Street, and nine to the Royal College of Science, Dublin. They are of the value of 50*l.* per annum each, and are tenable for three years. Three Exhibitions to each Institution are therefore generally vacated each year. They are competed for at the May examinations, and are held from year to year for three years, on the condition that the holder attends the lectures regularly during those years, and passes the examinations required for the associateship of the school. The Exhibitions entitle the holders to free admissions to all the lectures, and to the Chemical and Metallurgical Laboratories at those two institutions.

Persons not eligible for them.

All persons over 21 years of age, excepting artisans, and such as come within the category of persons paid upon under § XXXVI. p. 13, will be excluded from competing for the Royal Exhibitions. Special cases, however, must be determined according to the spirit of the rules, and the object of the endowment.

Calculation of results in the competition for Royal Exhibitions.

LV. *The competition for the Royal Exhibitions will be determined as follows :—*

The maximum number of marks obtainable in each subject, except Mathematics, will be in the

Elementary stage	-	100
Advanced stage -	-	200
Honours - -	-	400

In Mathematics the numbers will be in the

1*st stage*	100	
2*nd* ,,	200	
3*rd* ,,	300	*Honours* 500
4*th* ,,	150	
5*th* ,,	300	*Honours* 500
6*th* ,,	200	
7*th* ,,	400	*Honours* 600

But in each case the number of marks gained in the Elementary Stage (or in the 1*st stage in Mathematics) will be diminished by the minimum number required to pass in that stage, and the number of marks gained in the other stages will be diminished by* 20 *per cent. of the marks obtainable in that stage.*

The remainder will then be added together to determine the candidate's position.

But no candidate will be allowed to take an Exhibition who has not obtained at least as many marks as are required for a second class in stage 2 *of Mathematics.*

LVI. *Sir Joseph Whitworth's* scholarships of the value of 100*l.* per annum, tenable for two or three years, are also given in competition at the May examinations. **Whitworth Scholarships.**

Full instructions as to the subjects, time, place, conditions, &c. of the competition for these scholarships are given in the **Whitworth Prospectus,** which can be had on application to the Secretary, Science and Art Department.

Building Grants.

LVII. A grant in aid of a new building, or for the adaptation of an existing building, for a School of Science may be made at a rate not exceeding 2*s.* 6*d.* **Grants in aid of building Science Schools.**

per square foot of internal area, up to a maximum of 500*l.* for any one school, provided that the school—

a. be built under the Public Libraries Act (13 & 14 Vict. c. 65.; 18 & 19 Vict. c. 70.; 29 & 30 Vict. c. 114.), (*see* Summary of the Law relating to the establishment and maintenance of Public Libraries, &c., *Appendix A.*, p. 41); or—

b. be built in connexion with a School of Art aided by a Department building grant.

And provided that there is a population in the neighbourhood which requires a School of Science; that it is likely to be maintained in a state of efficiency; and that the site, plans, estimates, specifications, title, and trust deeds are satisfactory.

The regulations under which building grants to Schools of Science are made will be found in Appendix A., p. 43. (*Apply for* Science Form No. 349.)

Apparatus Grants.

Grants for apparatus.

LVIII. A grant towards the purchase of apparatus, diagrams, &c., of 50 per cent. on the cost of them, is made to Science Schools and Classes taught by duly qualified teachers under the supervision of Committees constituted in accordance with the § X., p. 4, and approved by the Department.

If at any time it is found that the apparatus, examples, &c., towards the purchase of which a grant has been made are not properly taken care of, the aid of the Department may be withdrawn.

Grants on the same scale will also be made to schools or classes not under qualified teachers in cases where the total value of the apparatus required is not above 10*l.*

Grants of apparatus to endowed schools.

LIX. As a general rule no endowed school is eligible to receive a grant towards the purchase of apparatus, &c., unless considerable local contributions are made in aid of it; and then only when the apparatus is clearly necessary.

Catalogues of apparatus.

LX. Catalogues containing priced lists of apparatus, instruments, diagrams, books, &c. from various

manufacturers have been prepared in the following sciences and can be had on application :—

(1.) Practical Geometry, Machine and Building Construction, and Mechanics.
(2.) Experimental Physics.
(3.) Chemistry.
(4.) Geology and Mineralogy, Natural History, (Physiology, Zoology, and Botany), and Physical Geography.

These catalogues contain the highest price of each article on which the aid of 50 per cent. is given. The applicant is at liberty to select a higher priced article, but the aid towards the purchase of it will be only 50 per cent. of the highest price above mentioned. Should a lower priced article be selected the aid will only be to the extent of 50 per cent. of its price.

Schools are also permitted to select a single copy of each of the text books given in the Syllabus, towards the purchase of which similar aid will be granted.

LXI. Committees requiring aid in the purchase of apparatus, &c. should apply for Science Form No. 49, and also for the catalogues referred to in the previous rule. Method of obtaining grants.

The Committee of the School or class may select any of the manufacturers whose names are given in the catalogues.

Orders from different tradesmen must be made on separate forms.

In filling up the Form No. 49, the number of the apparatus given in the catalogue must always be mentioned.

LXII. Payments, including charge for packing, must be made in advance to the manufacturers on receipt of the invoice. The goods to be sent at the risk of the purchaser. On obtaining a receipt from the Committee of the School (which is included in the form of Requisition) that the articles have been received, the remaining 50 per cent. will be paid to the manufacturer by the Department. Payments to manufacturers.

LXIII. Apparatus grants are rigorously confined to articles of a non-destructible nature; hence no aid will be afforded in the purchase of breakable articles, such as glass retorts, tests tubes, &c., nor, indeed generally, in the purchase of articles to be used by Limitation of grants.

the student, as distinguished from those of a permanent and illustrative character which are required by the Teacher in giving instruction in Science.

Grants are only made in the purchase of one object of the same kind. Duplicates of apparatus, &c. are not allowed at the reduced rate.

Supplementary Grants in certain Subjects, and Special Aid to Teachers and Students.

Navigation Schools.

LXIV. In addition to the ordinary science examinations in May, class examinations are held in Mathematics, Navigation, Nautical Astronomy, Steam, and Physical Geography for the benefit of seafaring men—and for them only—three times a year in all seaports where Local Committees are formed and are willing to undertake them. These examinations take place in the beginning of March, September, and December. The application for these examinations must be made on Science Form No. 119 before the 10th day of the previous month.

After May 1870 *these examinations will only be allowed when there are at least* 40 *candidates for examination, and in such subjects and stages only as there are* 40 *candidates.*

The payments to properly qualified teachers (*see* § XXXII., p. 11) on the results of the quarterly examinations for seamen, will be according to the same scale as that laid down for the ordinary May examinations (*see* § XXXVII., p. 13), and the regulations with regard to Committees (*see* §§ X. to XVI., pp. 4 to 6), registers (*see* § XLIII., p. 15), and number of lessons (*see* § XXXV., p. 12), must also be carried out in the case of Navigation Schools.

Extra grants in Subjects II. and III.

LXV. In order to encourage the artistic ability which may be shown in drawings of buildings and machines executed by students in Science classes, as exercises in Subjects II. and III. (*see* List of Science Subjects, p. 3), additional grants are made on the same scale as those for works executed in Art schools or classes.

a. The Local Committee or the Teacher of a Science school or class satisfying the condi-

tions stated in the next rule is entitled to receive a payment not exceeding 15*s*. for any one student, on account of every artisan student who shall submit satisfactory works executed in the school or class during the then current school year.

(1.) In Mechanical and Machine drawing; and,

(2.) In drawing details of Architecture from copies.

(Art Directory, p. 24, § 3*b*, and p. 36, Stage 23*a*.)

b. The Local Committee or the Teacher of a Science school or class is entitled to receive a payment not exceeding 20*s*. for any one student, on account of every artisan student who shall submit satisfactory works, executed in the school or class during the then current school year, in drawing or designing for Architecture.

(*See* Art Directory, p. 25, § 3*c*, and p. 36, Stage 23*b*.)

c. Architectural Drawings of the class referred to in the preceding paragraph (§ *b*), executed by students in Science schools or classes are admissible to the advantages of the National Art Competition. (*See* Art Directory, p. 29, § 11.)

The works of students of classes in Subjects II. and III. are not excluded from the advantages of this rule, even if such students should be teachers in other Science subjects.

LXVI. Local Committees, Teachers, and Students of Science schools may avail themselves of the aid offered under the provisions of the above rule, if the Teacher be duly qualified in accordance with § XXXII. (*see* p. 11), to earn payments on the results of examination in Subjects II. and III., and have passed the second grade examination in Freehand Drawing (*see* Art Directory, p. 16). Condition of obtaining extra grants.

This last condition will not be imposed on those Teachers who, being qualified in Subjects II. and

III. before the year 1869, have passed not less than one hundred pupils in either subject, or fifty in both subjects.

Full particulars of the aid given to Art schools and classes will be found in the Art Directory, which can be had on application to the Secretary, Science and Art Department.

Free admissions to School of Mines and College of Science.

LXVII. Free admissions to the lectures at the Royal School of Mines, Jermyn Street, or the Royal College of Science, Dublin, are granted to any person who takes a gold medal in the May examination.

Admission to Educational and Art Libraries.

LXVIII. Candidates who have obtained a first or second class in the advanced stage may obtain tickets of admission to the Educational and Art Libraries at the South Kensington Museum on application, by letter, addressed to the Secretary of the Science and Art Department.

Visits of teachers to London.

LXIX. Science teachers who have taught two years consecutively and passed not less than 30 students each year, are allowed 2nd class railway fare and 3*l.* towards their expenses while living in London —on condition that they remain there five days at least—for the purpose of visiting the South Kensington Museum and other Metropolitan institutions, in order that they may acquire for the benefit of their students a knowledge of the latest progress in those educational subjects which affect the schools.

Special arrangements with regard to these visits may be made from year to year.

Before he proposes to take advantage of the grant the teacher must make application to the Secretary, Science and Art Department: he must also keep a diary (*apply for* Science Form No. 302) during his stay in London, giving the names of the institutions he has visited, with brief observations on them.

Note.—All the forms alluded to in this Directory, as well as the *Science Directory* and the *Art Directory* (price 6*d.* each), can be had on application to the Secretary, Science and Art Department, South Kensington, London, W.

Letters addressed thus need not be prepaid in the post.

APPENDIX A.

FORMS and INSTRUCTIONS for GUIDANCE in establishing and maintaining SCIENCE SCHOOLS and CLASSES.

SCIENCE FORM, No. 170.

MEMORANDA FOR THE USE OF SECRETARIES AND MEMBERS OF SCIENCE COMMITTEES.

Dates.	
Constantly - - -	To visit the School and see that the Registers are kept from day to day, and that the regulations of the Department are duly carried out.
When required -	To summon a meeting of the Committee on the occasion of the visit of the Inspector.
1*st November* -	The Report, Science Form No. 120, informing the Department of the existence of a school must be carefully filled in and sent immediately on its opening, or if it be an old school, on its reassembling after the vacation. This must be accompanied or closely followed by Form No. 88, forming the Committee, or No. 168, continuing a Committee.
	Note.—If the Committee of any School or Class has not been at least provisionally approved by the Department before the 1*st of February in any year, no payments will be made on the results of the examination of that School or Class in the ensuing May.*
Before 28*th Feb.* -	To send Form No. 329, stating in what subjects examination will be required.
Before 31*st March*	To send Form No. 119, giving the precise number of candidates in each subject at the examination in May.
	Note.—No examination will be held where these forms have not been sent in by the dates named.
Before 24*th April* -	To see that Form No. 91 is hung up in the Schoolroom.
On the 27*th April*	If a parcel containing (1) the papers for the candidates to work upon, (2) copies of Form No. 91, one for each day's examination, and (3) envelopes in which to return the worked papers, should not have been received, or if there should be any mistake in the numbers sent for each subject as applied for, or in the covering letter, to communicate *at once* to the Department.
During the May examinations.	The examination papers for each evening will leave London by the night mail two evenings before, *i.e.*, Thursday evening papers will leave on Tuesday evening, Friday's on Wednesday evening, etc. Should they not arrive accordingly, a telegram to be sent *at once* to the Department.

On the evening of examination. The candidates, being all seated at 6.50, to read out the rules on Form No. 91, then give out the papers to be worked on. Then at 6.55 to break the seal of the examination papers and distribute to the candidates. To adhere rigidly to the rules on Form No. 91. To sign Form No. 91. To seal up the papers in one of the envelopes provided and at once post them.

After the May examinations. On receiving printed lists of the results, to give one copy to each candidate whose name appears in it as being successful; to inform the others that they have failed.

To return, as soon as possible, Form No. 161, filled up in strict accordance with the rules on Form No. 110. (Prize List). To call a meeting of the Committee to examine and certify the Teacher's claims for payment, Form No. 51, and the School and Class Registers, which must be sent up at the same time. To return Form No. 108.

To keep a record, and inform the Department, of the number of individuals examined.

SCIENCE AND ART FORM, No. 88.

LOCAL COMMITTEES FOR SCHOOLS AND CLASSES RECEIVING AID THROUGH THE SCIENCE AND ART DEPARTMENT.

1. A Local Committee of not less than five well-known responsible persons must be formed in connexion with every school or class, in order to comply with the necessary requirements of the Science and Art Department, and to carry out various arrangements on its behalf necessary for testing the efficiency of the instruction, on the proof of which alone the aid of the Department will be given.

2. The gentlemen who intend to act on this Committee must sign the form on the next page, stating their willingness to carry out the necessary arrangements for examinations, and to observe all the regulations of the Department; each member after signing must also give his address and occupation. Care must be taken that the members who sign the form are properly acquainted with the duties they propose to discharge; a summary of these duties is given below (see § 5), and they are laid down at greater length in the Science and Art Directories, which can be obtained on application to the Secretary of the Department.

3. When a school or class is first formed, the form on the next page must be signed at a general meeting of the Committee. If the same Committee continue to act, it will only be necessary to fill up Form No. 168, which expresses the willingness of the members to undertake their duties for another year: but no one can be a member of a Committee, nor assist in the conduct of an examination, who has not signed the form on the next page.

4. The relation of the teacher to the Committee of a school or class will vary much, according to the varying circumstances of different

localities. With this and other local arrangements the Science and Art Department does not interfere, but leaves them to the locality to settle.

5. The Science and Art Department requires that the Local Committee shall—

a. Be responsible for the safe custody of all apparatus towards the purchase of which the Department has granted aid.

b. Provide a room or rooms of sufficient size to carry out the annual examination according to the detailed regulations under that head. This examination is of *all* persons who wish to present themselves, and not only of those attending the school or class; but those persons who do not belong to the school or class must send in their names at the appointed time, and may be required to pay a registration fee of 2*s.* 6*d.* for the whole examination.

c. See that school registers, showing the occupations of the various students, their attendance, number of lessons, payments of fees, &c., on approved forms, be kept properly filled up, and sent to the Science and Art Department when required.

d. Send, when required, to the Secretary of the Science and Art Department the list of students to be examined, specifying the subjects in which they are to be examined. Be responsible for conducting and superintending the examinations in accordance with the rules of the Department; giving out the examination papers which will be sent for that purpose: seeing them fairly worked and certifying to the same, not less than three of the Committee being always present: and sending the worked papers, under seal, by the day's post to the Secretary of the Science and Art Department.

e. When required, transmit to South Kensington works for examination executed in the school during the previous year, and make an annual report of the proceedings of the school or class.

f. Certify that those students on whose examination claims to payments on results are based, are artisans or operatives, or can claim as such; and that the payments claimed are due according to the regulations.

g. Certify that those students, on account of whose instruction in Science payments are claimed, have received 25 lessons at least from the teacher in the year, or since the last examination, on their passing at which payment was claimed on their account.

6. The school or class must be at all times open to the visit and inspection of the officers of the Science and Art Department as a condition for the grant of aid from it; if at any time it is found that the apparatus, examples, &c., towards the purchase of which a grant has been made are not properly taken care of, or that a proper room with firing, lighting, &c., is not provided for the class, the aid of the Department will be withdrawn.

7. The school or class will be inspected periodically by an officer of the Science and Art Department, who will report whether the regulations be strictly carried out. At his visits, of which due notice will be given, a meeting of the Committee must be held to receive him, at which as many of the members as possible are expected to attend.

FORM of APPLICATION to act as a COMMITTEE for a SCHOOL or CLASS receiving AID through the SCIENCE and ART DEPARTMENT.

This Form is to be filled in, signed at a general meeting of the Committee, and returned to the Department immediately on the formation of a school or class.

If the Committee of any school or class has not been at least provisionally approved by the Department before the 1st February in any year, no payments will be made on the results of the examination in the ensuing May of that school or class.

When a Committee continues to act for another year for a school or class, Form No. 168 should be transmitted instead of this form.

We, the undersigned,

[h. The Committee must consist of a Chairman, Secretary, and at least three other Members, and must be composed entirely of well-known responsible persons of independent position, who have no such personal interest in the school or class as can lay them open to the slightest suspicion of partiality. Relations and pupils of the teacher, persons under instruction in any school or class receiving aid from the Science and Art Department, and teachers of any description having pupils who are candidates for the examinations of the Department, are not eligible as members of the Committee.

NOTE.—A gentleman whose son attends any examination of the Science and Art Department is thereby disqualified from superintending any of the examinations that year, though he may act on the Committee in other respects.

i. It is very desirable that as many persons as possible in recognised positions of public responsibility in the district, such as Magistrates, Municipal Authorities (Mayor, Aldermen, or Town Councillors), Heads of Educational Establishments (Trustees of Grammar Schools, Managers of National Schools), Clergymen, &c., should be on the Committee. It is absolutely necessary that at least two such responsible persons should agree to act.

k. The Chairman must be a Magistrate, Mayor, Boroughreeve, Provost, or Alderman, or other public officer of recognised position, Trustee of Grammar School, or Clergyman of the Established Church in parochial employment. He will have to certify that the constitution of the Committee is in accordance with the above requirements.

l. The Secretary of the Committee of the School or Class, as being the medium of communication, will carry on all correspondence with the Science and Art Department, and is held responsible for making out and sending all returns required, for the receipt and distribution of the examination papers, the transmission of the worked papers, &c., at the proper times according to the regulations.]

propose to act as the Local Committee for the

______________________________ [Science School, Science Class, School of Art, or Art Night Class.]

held at the ______________________________ [Name of Institution or Building.]

______________________________ [Name of Street or Place.]

______________________________ [Name of City, Town, or Village.]

and taught by ______________________________

____

______________________________ [Give the names of all the teachers.]

We undertake for the year ending 31st August 18 at least, and further till another Committee satisfactory to the Science and Art Department has been appointed,

1. To be responsible for the safe custody of all the Apparatus, Diagrams, Examples, Casts, &c., towards the purchase of which the Department has in any way contributed.

2. That three or more of our number will be ready at the appointed time to be present at, and superintend, the examinations of the School or Class according to the instructions of the Science and Art Department, and give the teachers the necessary vouchers.

3. That a room or rooms shall be provided for the due carrying out of such examination, according to the rules of the Department, providing sufficient space for the examination, not only of all persons taught in the School or Class, but of all others who may wish to attend the examination.

4. When required to transmit to South Kensington works for examination, and to make an annual report of the School or Class; and to comply with the regulations of the Science and Art Department.

(A fee of not more than 2*s.* 6*d.* may be charged on each applicant for examination who is not a student in the class, to reimburse the Committee for any extra expenses they may be put to in providing a room.)

5. That the School or Class shall be open at any time to the visit and inspection of the Officers of the Science and Art Department.

Signature.	Address.	Occupation, specially stating how fulfilling the conditions of rules "*h*" and "*i*" above.
Note.—*On the formation of a Committee this form should be signed at a general meeting.* ______ *Chairman.* ______ *Secretary.*		

I certify that this Committee complies with the requirements of the rules *h*, *i*, and *k*.

______

Chairman.

The Secretary,
Science and Art Department,
South Kensington, London, W.

SCIENCE AND ART FORM, No. 168.

FORM OF APPLICATION TO RENEW A COMMITTEE.

To be sent in before the 30th November.

SIR,

WE have the honour to inform you that a meeting of the Committee of

the ________________ [Science School, Science Class, School of Art, or Art Night Class.]

established at the ________________ [Name of Institution or Building.]

at ________________ [Name of Town or Village.]

was held at the ________________ [Place of Meeting.]

on the ________________, at which the following members were present:—

and we were authorised by them and the following members,

who could not attend, to inform you that they are prepared to continue to act

as the Committee of the ________________ [School or Class.]

for the year ending 31st August 18 .

We have also to inform you that additional members who have joined the Committee have signed the enclosed Form No. 88. [This paragraph to be erased if it does not apply.]

The School will be taught by the following teachers during the session:—

____

____

____

We have the honour to be, SIR,
Your obedient Servants,

________________ *Chairman.*

________________ *Secretary.*

To the Secretary,
Science and Art Department,
South Kensington, London, W.

SCIENCE FORM, No. 120.

SCIENCE CLASSES UNDER TEACHERS QUALIFIED TO EARN PAYMENTS.

ANNUAL REPORT OF SCIENCE SCHOOL OR CLASS,

To be made on its establishment, and annually immediately on recommencing after the summer vacation.

In all cases this form must be sent in before the 1st November.

Name of Town ______________________________

Place, as Mechanics' Institution, &c., in which the Classes are held } ______________________________

Name of Street, No., &c. ______________________________

Teachers' names.	Their private addresses.

Total No. of individual Students ______________

(If a student attends two or more classes he must only be counted as one student.)

CLASSES IN (state subject).	Fees.	No. of Students.	Days on which they meet.	Hours of Meeting.	Period of the Year during which the Classes continue.

______________________________ *Secretary.*

______________________________ *Address of Secretary.*

SCIENCE FORM, No. 51.

Application for Payment from ______________________ [Name of teacher.]

Science Teacher in ______________________ [Name of school or institution.]

at ______________________ [Name of town or village.]

On behalf of the Committee of Management of this School, We do hereby certify that :—

(1.) Mr. ______________________ has duly performed the various duties devolving upon him as a Science Teacher in the School, during the ________ ending ________ day of ________________ 18 .

(2.) He has given the following students at least 25 lessons during the year, or since the last examination at which payment was claimed on their account, in each subject for which payment is claimed.

(3.) The under-mentioned students belong to the industrial classes, as coming within one of the following categories, or are the children (not earning their own livelihood) of such :—

a. Artisans or operatives in the receipt of weekly wages.
b. Coastguards, policemen, and others who, though in the receipt of weekly wages, do not support themselves by manual labour.
c. Persons in the receipt of salaries not large enough to render them liable to the income tax, as some descriptions of clerks, shopmen, &c.
d. Small shopkeepers employing no one but members of their own family, and not assessed to the income tax.
e. Tradesmen and manufacturers on their own account, supporting themselves by their own manual labour, not employing apprentices, journeymen, &c., and not assessed to the income tax.

Examined and certified at a meeting of the Committee held for that purpose at ____________ [Place of meeting.] on the ______ day of ______ 18 .

______________________ *Chairman* or *Secretary*.

____
______________________ } *Two members of Committee.*

I hereby certify that the following particulars are correct.

______________________ *Teacher.*

______________________ [State how qualified to earn payment.]

Names of Passed Students.

N.B.—The names of the students must be arranged alphabetically. After each student's name must be placed, each in a separate line, his several successes (if he has more than one); and in the last column the amount claimed on each success, after making the proper deductions.

Surname.	Christian Name in full.	Age last Birthday.	Trade, or Father's Trade. When father's trade is given put (✓.) after it.	State under which of the Categories, *a*, *b*, *c*, *d*, *e*, Claim is made.	Position at the late Examination.			Highest Position in same Subject in any previous Examination.	Payment claimed.
					Subject. *In Roman Numerals.*	Stage.	Class. *In Arabic Numerals.*		

[SPECIMEN.]

SCIENCE FORM, No. 51.

Application for Payment from *William Brown,* [Name of teacher.]
Science Teacher in *the Mechanics' Institute,* [Name of school or institution.]
at *Worksop* [Name of town or village.]

On behalf of the Committee of Management of this School, We do hereby certify that:—

(1.) Mr. *William Brown* has duly performed the various duties devolving upon him as a Science Teacher in the School, during the *year* ending *30th* day of *June* 1870;

(2.) he has given the following students at least 25 lessons during the year, or since the last examination at which payment was claimed on their account, in each subject for which payment is claimed;

(3.) the under-mentioned students belong to the industrial classes, as coming within one of the following categories, or are the children (not earning their own livelihood) of such:

a. Artisans or operatives in the receipt of weekly wages.
b. Coastguards, policemen, and others, who though in the receipt of weekly wages, do not support themselves by manual labour.
c. Persons in the receipt of salaries not large enough to render them liable to the income tax, as some descriptions of clerks, shopmen, &c.
d. Small shopkeepers employing no one but members of their own family, and not assessed to the income tax.
e. Tradesmen and manufacturers on their own account, supporting themselves by their own manual labour, not employing apprentices, journeymen, &c., and not assessed to the income tax.

Examined and certified at a meeting of the Committee held for that purpose at *the Mechanics Institute, Worksop* [Place of meeting.] on the *25th* day of *July* 1870.

John Richards, Chairman ~~or Secretary~~.

Alfred H. Dickson
Walter Harrison } Two members of Committee.

I hereby certify that the following particulars are correct.

William Brown, Teacher.

2nd Class Certificate in I., II., III.; 1st Class in X. and XI., 1867; 2nd Class in VIII. and IX., 1868; 2nd Class Honours in IV., 1869. [State how qualified to earn payment.]

NAMES OF PASSED STUDENTS.

N.B.—The names of the students must be arranged alphabetically. After each student's name must be placed, each in a separate line, his several successes (if he has more than one); and in the last column the amount claimed on each success, after making the proper deductions.

Surname.	Christian Name in full.	Age last Birthday.	Trade or Father's Trade. When father's trade is given put (*f.*) after it.	State under which of the Categories, *a, b, c, d, e,* Claim is made.	Position at the late Examination. Subject. *In Roman Numerals.*	Stage.	Class. *In Arabic Numerals.*	Highest Position in same Subject in any previous Examination.	Payment claimed.
Adams -	*John James.*	*14*	*Tailor (f.)*	*e.*	*X.*	*A.*	*1*	*E.*	*£2*
"	"	"	"	"	*XI.*	*E.*	*2*	—	
			Carried over -		- -	- -	- -	- -	*£3*

Names of Passed Students.

N.B.—The names of the students must be arranged alphabetically. After each student's name must be placed, each in a separate line, his several successes (if he has more than one); and in the last column the amount claimed on each success, after making the proper deductions.

Surname.	Christian Name in full.	Age last Birthday.	Trade, or Father's Trade. When father's trade is given put (*f*.) after it.	State under which of the Categories *a*, *b*, *c*, *d*, *e*, Claim is made.	Position at the late Examination. Subject. *In Roman Numerals.*	Stage. *A. or E.*	Class. *In Arabic Numerals.*	Highest Position in same Subject in any previous Examination.	Payment claimed.
									£ s.
	Brought forward			- -	- -	- -	- -	- -	*3 0*
Carter -	*William Henry.*	*22*	*Clerk in Gas Works.*	*c.*	*X.*	*E.*	*1*	*E. 3*	*1 10*
Jones -	*Richard*	*23*	*Bricklayer*	*a.*	*I.*	*E.*	*1*	*E. 2*	*1 0*
"	"	"	"	"	*III.*	*A.*	*2*	*E. 2*	*1 0*
Robinson	*Peter Charles.*	*20*	*Fitter* -	*a.*	*I.*	*A.*	*1*	*A. 3*	*1 0*
"	"	"	" -	"	*II.*	*A.*	*2*	*E. 1*	*1 0*
"	"	"	" -	"	*IV.*	*E.*	*2*	—	*1 0*
Smith -	*Robert*	*13*	*Postman (f).*	*b.*	*VIII.*	*A.*	*1*	*E. 2*	*2 0*
"	"	"	"	"	*IX.*	*E.*	*2*	*E. 3*	*0 10*
"	*Arthur H.*	*15*	*Publican (f).*	*d.*	*IV. and V.*	*3*	*1*	*A. 2 in IV.*	*2 0*
Thomson	*Charles*	*16*	*Office-boy*	*b.*	*IV. and V.*	*1*	*1*	*E. 3 in IV.*	*Nil.*
"	*George* -	*19*	*Joiner's App.*	*a.*	*IV. and V.*	*3*	*1*	*A. 1 in IV.*	*1 0*
"	"	"	"	"	*IV. and V.*	*4*	*2*	*E. 3 in V.*	*1 0*
"	"	"	"	"	*IV. and V.*	*6*	*2*	"	*1 0*
Watson	*William*	*18*	*Pupil-teacher.*	*c.*	*IV. and V.*	*3*	*2*	*A. 2 in IV.*	*1 0*
"	"	"	"	"	*IV. and V.*	*5*	*1*	*E. 2 in V.*	*1 0*
"	"	"	"	"	*IV. and V.*	*7*	*2*	"	*1 0*
									20 0

SCIENCE FORM, No. 91.

RULES FOR THE CONDUCT OF SCIENCE EXAMINATIONS.

The following rules must be hung up in the examination room for the information of the candidates one week before the examination. They should all be carefully read by the members of the Committee, and those applying to the candidates must be read aloud before the Committee and the candidates **on each night** *immediately before the examination begins.*

Directions to the Committee.

1. If one room is used, three of the Committee must be present during the whole of the examination, if more than one room then two of the Committee in each room, who must carefully watch the whole examination and see that candidates use no unfair means either by assisting one another or using books or notes. The members of the Committee can, if they wish it, relieve one another, as long as the correct number are always present. *No persons except those under examination, members of the Committee, and officers of the Science and Art Department are permitted to be present in the room during the examination.*

Note.—When there are not more than three candidates it will not be necessary for more than two members of the Committee to be present at the examination.

2. Places must be allotted to the candidates so that they may be seated at least five feet apart, from centre to centre. Ink and pens must be provided. All diagrams, &c., having reference to the subjects of the examination, must be removed from the walls of the examination room. All these arrangements for the accommodation of candidates should be completed by 6.30 p.m.

3. It may be of service to the Committee that the teacher of the class should attend before the examination begins to assist in getting the candidates into their places; his doing so, however, is at the discretion of the Committee. He may see the candidates fill up the forms on the outside of their papers and arrange them in classes for the elementary and the advanced papers, and for honours, which he will explain to the Committee so that there may be no confusion. But *he must leave the room before the examination papers are opened:* information of his having remained in, or returned to the room after this will lead to the examination being cancelled.

Note.—Should the teacher of the class wish to sit at the examination, he must apply specially to the Committee, so that they may arrange to have a table for him close to their own seats, and not with the other candidates.

4. The blank papers supplied by the Department for the candidates to write their answers on should be first distributed, and the Committee should see that the candidates commence by filling in their names, &c., where directed. The arrangement of the candidates and distribution of the papers should be completed before 6.50 p.m.

Note.—Should no candidate present himself for examination, the packet of examination papers must be returned to the Department by the next post *unopened*.

5. At 10 p.m. (on the nights of the examination in subjects I., II., and III., at 11 p.m.), or, as much sooner as all the candidates have completed their papers, the worked papers must be sealed up in the envelope supplied by the Department for that purpose. Before they are thus sealed up neither the teacher nor any other person, not being a member of the Committee, must be allowed to enter the room.

6. On these examinations depend large grants of public money. On their being fairly, honestly, and impartially carried out depends the continuance of the system. The Committees are intrusted with this duty. They will see, then, how necessary it is to be extremely careful in conducting the examinations, and to insist on the rules being complied with *to the letter*. They are therefore required to fill in and sign the certificate on the third page of this form, and to forward the same with each set of worked papers.

The worked papers of the candidates are, as will be seen from Rule 12, below, to be initialed by members of the Committee. This is to prevent personation. And the Committee will see how essential it is that this duty be not treated as a mere matter of form.

Regulations applying to the Candidates.

To be read to the Candidates on each evening before the Examination Questions are opened.

7. The candidates must be in their places at 6.50 p.m. After this time no candidate must be admitted except under very exceptional circumstances, and by express permission of the Committee, and then *only* if no person has left the room who has seen the examination paper. No candidate must on any account be admitted after 7.30 p.m.

8. The examination papers must be opened in the examination room in the presence of the Committee, at 6.55 p.m. No examination paper may on any pretence be taken from the room before 8 p.m.; nor after that hour until every candidate has completed and given up his worked paper.

9. Candidates should not bring anything with them into the examination room,* except pens and pencils. No *blotting paper*, scribbling paper, slates, or anything of the sort that might be passed from one candidate to another, is on any account to be allowed. Rough work and calculations must be done on the supplied form. The back of each leaf of the form, *i.e.*, pages 2, 4, 6, and 8, may be reserved for this purpose, the pen being drawn through to show that they are not for the examiner. *But nothing must be torn off the form.* All books, note-books, &c. must be collected by the Committee.

10. Candidates must not on any pretence whatever speak to one another after the papers have been given out. If a candidate should require to ask a question, he will hold up his hand, when a member of the Committee will attend to him, but no question on the meaning of any portion of the examination paper must be asked or answered.

11. When the examination papers have been given out no candidate must be allowed to return after having once left the room.† On a candidate leaving the room before the examination is over his worked paper and examination questions must be taken up, and he must deliver his paper of questions to the Committee. At 10 p.m., precisely,‡ all the candidates' papers must be collected. It will therefore be advisable to warn them ten minutes before the time. When a candidate has completed his work before 10 p.m. he should, with the permission of the Committee, go away, though not before 8 o'clock, after his worked paper has been taken by a member of the Committee.

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* Except such as by the Time Table (Science Form, No. 90) are required.

† It will, therefore, be desirable to make some arrangements for the candidates to retire within the room.

‡ Except in the Drawing Examinations, subjects 2 and 3, then the hour is 11 p.m.

12. The papers must be initialed, by the Committee as directed, as they are received from each candidate, as a guarantee that each has been worked by him whose name, &c. it bears.

13. *Should a candidate break any of the foregoing rules, or use unfair means of any description, he must be at once expelled the examination room, and his paper cancelled, the Committee stating on it the cause of his expulsion.*

Certificate by the Committee.

To be filled in and signed by the Committee and forwarded with each set of worked papers.

We, the undersigned members of the Committee of the Science School or Class held at ______________________________

______________________ [name of institution and town.] in ______ [state number of] rooms hereby certify that we were present during the examination

____ [state Subject.]

held in the ______________________________ [name of building.] on the evening of the ________________ where the accompanying papers were worked in our presence, and that the foregoing rules have been strictly complied with.

Dated this __________ day of ______________ 18 .

Signatures.	Time Present.	
	Hour of Arrival.	Hour of Departure.

FORM No. 694.

SUMMARY of the LAW relating (I.) to the ESTABLISHMENT and MAINTENANCE of PUBLIC LIBRARIES, MUSEUMS, and SCHOOLS of SCIENCE and ART, and (II.) to the ACQUISITION of SITES for such INSTITUTIONS.

N.B.—This summary has been prepared for the **general information only** *of persons desiring to establish Museums and Science and Art Schools, but it must be clearly understood that the Department does not hold itself responsible for its legal accuracy, and the promoters of such institutions are recommended not to take any definite proceedings under the Acts without availing themselves of professional advice.*

I.

1. Any town, parish, district, or union of parishes, is empowered by Act of Parliament (the Act for England is the 18 and 19 Vict. c. 70, Public Libraries Act, 1855; amended by the 29 and 30 Vict. c. 114. *As regards Scotland and Ireland, see* §§ 10 and 11 *below*), to levy a rate not exceeding one penny in the pound for the establishment and maintenance of buildings, with the requisite appliances, suitable for Public Libraries and Museums, or for Schools of Science or Art, or for any or all of these purposes, provided that a majority of more than one-half of the ratepayers present at a public meeting, duly convened, vote in favour of adopting the provisions of the Act.

2. The preliminary steps to be taken with a view to the adoption of the Act are these :—

(*a*.) In *Municipal Boroughs* the Act requires that the mayor shall convene a public meeting on the request of the town council, or on the request in writing of any ten resident ratepayers;

(*b*.) In *Districts* within the limits of any Improvement Act, the district board is to convene a meeting upon the requisition in writing of at least ten resident ratepayers; and

(*c*.) In *Parishes*, the overseers of the poor, on the written requisition of ten resident ratepayers, are to convene a meeting to determine whether the Act shall be adopted.

3. In each case it is necessary that ten clear days' notice of the time, place, and object of the meeting be given by affixing the same on or near the door of every church and chapel, and at least seven days' notice by advertisement in a newspaper published or circulating in the borough, district, or parish, as the case may be.

4. Any expenses incurred in connexion with the meeting, whether the Act be adopted or not, are chargeable upon the borough fund or rates, and may be defrayed, if necessary, by a separate rate specially levied for the purpose, such rate not to exceed one penny in the pound.

5. If any meeting duly convened to determine as to the adoption of the Act decides against it, no meeting for a similar purpose can be held until the expiration of at least a year from the time of holding the previous meeting.

6. If the Act be adopted the organisation for carrying its provisions into operation is as follows :—

(*a*.) In *Boroughs*. "The management, regulation, and control of "libraries and museums, schools for Science and Art, shall be "vested in and exercised by the council," or by such committee

as the council may appoint, and the members of the committee are not required to be members of the council.

(*b.*) In *Districts*. The board or trustees acting in the execution of the Improvement Act, or a committee appointed by them.

(*c.*) In *Parishes*. Not less than three nor more than nine commissioners to be appointed by the vestry, are constituted a body corporate for the purposes of the Act, under the name of "The "Commissioners for Public Libraries and Museums for the Parish "of —— in the County of ——."

7. The council, board, or commissioners are empowered to borrow money at interest, on the security of a mortgage or bond of the borough funds, or of the rate levied under the Act; and the provisions of the Companies Clauses, and Lands Clauses Consolidation Acts, 1845, are incorporated with the Public Libraries Act.

8. Where two or more neighbouring parishes combine for the purposes of the Act, each parish is to appoint not more than three commissioners, and the commissioners for the several parishes are to form one body corporate, and to act together in the execution of the Act. The expenses of carrying the Act into operation are to be borne by the parishes in such proportions as they may mutually approve.

9. It is important to observe that where a public museum or library has been already established under any Act relating to public libraries or museums, a similar institution, such as a School of Science or Art, may be established in connexion therewith without any further proceedings being taken under the Act.

10. The following are the general Acts of Parliament relating to the establishment and maintenance of public libraries, museums and Schools of Science or Art. Those printed in italics have been superseded by the others:—

Stats. 8 *and* 9 *Vict. c.* 43; 13 *and* 14 *Vict. c.* 65; 16 *and* 17 *Vict. c.* 101; 17 *and* 18 *Vict. c.* 64; 17 *and* 18 *Vict. c.* 103; 18 and 19 Vict. c. 40 (Public Libraries Act, Ireland, 1855); 18 and 19 Vict. c. 70 (Public Libraries Act, 1855); 29 and 30 Vict. c. 114 (Public Libraries Amendment Act, England and Scotland, 1865), repealed so far as it relates to Scotland by the 30 and 31 Vict. c. 37 (Public Libraries Act, Scotland, 1867).

11. The provisions relating to the establishment and maintenance of libraries and museums, &c. in Scotland and Ireland are substantially the same as the provisions of the Act for England, but there are some differences in matters of detail, for which it will be advisable to refer to the Acts themselves, namely, for Scotland, Stat. 30 and 31 Vict. c. 37, and for Ireland, Stat. 18 and 19 Vict. c. 40.

II.

12. By 17 and 18 Vict. c. 112 (intituled "The Literary and Scientific "Institutions Act")—after reciting the expediency of affording greater facilities for obtaining and settling sites and buildings in trust for institutions established for the promotion of literature, science or art, or for the diffusion of useful knowledge; it is provided that such persons and corporations, as are described in the 4 and 5 Vict. c. 38,* may

* These are, (1) any person being seised legally or equitably in fee simple, fee tail, or for life, in any manors or lands of freehold, copyhold, or customary tenure, and having the beneficial interest therein, in possession for the time being; and (2) any corporation, ecclesiastical or lay, sole or aggregate, in whom land may be, in any manner, vested,—subject to the proviso that no ecclesiastical corporation sole below the dignity of a bishop may make such grant without the consent in writing of the bishop of the diocese.

grant, convey, or enfranchise, either by gift, sale, or exchange, in fee simple, or for a term of years, any quantity, not exceeding one acre of their land, for each separate institution, as a site for such institution.

13. These powers are subject to provisos that they shall not be exercised by tenants for life unless the person or persons next in remainder join in the grant; that in case of gratuitous conveyance of waste or commonable land by any lord of a manor, the rights of all commoners and others having interest shall be barred; and that upon any land so granted by way of gift ceasing to be used for the purposes of the institution, it shall revert to the estate out of which it was granted, except only that when the institution is removed to another site, the land may be exchanged or sold for the benefit of the institution. The same Act, of 17 and 18 Vict. c. 112, contains numerous provisions relating to the persons by and to whom, and the manner in which, conveyances may be made; the form of such conveyances; the subsequent sale or exchange of the land; the liability of trustees to whom land is conveyed in trust; the ownership of any personal property belonging to the institution; the power to make byelaws; and the manner in which the institution may afterwards extend or abridge the purposes for which it was established, or may effect its own dissolution or the adjustment of its affairs.

14. The Act applies to every institution, for the time being, established for the promotion of science, literature, the fine arts, for adult instruction, and for the diffusion of useful knowledge. It also applies to the foundation and maintenance of libraries or reading rooms for general use among the members or open to the public, of public museums and galleries of paintings and other works of art, collections of natural history, mechanical and philosophical inventions, instruments, or designs.

15. The conveyance of sites to trustees, or others associated together for educational purposes, has been still further facilitated by recent legislation. It is no longer necessary to acknowledge any deed in order that it may be enrolled in the Court of Chancery (Act 31 and 32 Vict. c. 44. s. 3). If the grantor be a corporation, or if the conveyance be really and bonâ fide made for a full and valuable consideration, enrolment *is no longer compulsory*, although it is still permitted; but in all cases of voluntary grants by individuals, the deed must still, in conformity with the Mortmain Acts (9 George II. c. 36, 9 George IV. c. 85), be enrolled within six calendar months from the date of its execution (31 and 32 Vict. c. 44. s. 2).

SCIENCE FORM, No. 349.

REGULATIONS UNDER WHICH BUILDING GRANTS TO SCHOOLS OF SCIENCE ARE MADE.

1. A grant in aid of a new building suitable for a School of Science, or for the adaptation of an existing building, will be made provided that the school be built—

   a. Under the Public Libraries Act (13 & 14 Vict. c. 65.; 18 & 19 Vict. c. 70., 29 & 30 Vict. c. 114.), or,

   b. In connexion with a School of Art aided by a Department building grant; and subject to the conditions herein-after set forth.

2. All applications for grants out of the parliamentary vote for any year must be sent in on or before the 15th day of November in the year preceding.

3. No grant will be made unless their Lordships are satisfied that,—

a. There is a population in the neighbourhood which requires a School of Science.

b. The school is likely to be maintained in efficiency.

4. No grant will exceed 2*s*. 6*d*. per square foot of internal area, and no grant will exceed 500*l*.

5. The site, plans, estimates, specifications, title and trust deed, must be satisfactory to the Lords of the Committee of Council on Education.

6. A plan of the site must be forwarded drawn to a scale of one-eighth of an inch to a foot, and showing the boundaries, approaches, and abuttals.

7. The site must be—

a. In a situation not unhealthy or noisy.

b. Within convenient distance of the homes of the students.

c. If possible freehold in tenure, without incumbrance of rights reserved over the surface, or reservation of minerals.*

8. The size and number of rooms will depend on local circumstances and the different sciences to be taught in the school. The plans and sections must be submitted with the application for the grant, and the proposed buildings must be in accordance with the regulations then in force as to size and distribution of rooms, ventilation, and substantial construction.

9. In cases where they may think it necessary, their Lordships will send an officer of the Department to inspect and report on the suitability of the building and site for the purposes of a School of Science.

10. The plans, specifications, and estimates when approved and sealed may be returned to the promoters for use, but must be lodged in the Science and Art Department.

11. A trust deed must be prepared providing—

a. That the building be used † as "a school for the instruction of "children and adults in the pure and natural sciences appli-"cable to industry and manufactures."

b. That it shall be open at all times to the inspection of the officers of the Science and Art Department.

c. That the students shall be instructed by teachers qualified to earn payments on the result of their teaching.

d. For the constitution of a body of responsible trustees and a committee of management.

12. This trust deed must not be executed until it has been approved in draft by the Lords of the Committee of Council on Education.

13. When the trust deed has been executed, and if necessary enrolled, a copy of it, including all signatures, attestations, and endorsements, must be made on plain unstamped paper, and lodged in the Science and Art Department.

14. The grant is made on presentation of a certificate (with balance sheet annexed) by the building committee of the school, setting forth that the building and conveyance are duly completed, and that the money in hand will, when added to the grant, meet all claims and finally close the account.

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* A leasehold site is not accepted by their Lordships when a freehold site can be obtained.

† If any power of sale, or of appropriating the premises to other uses than those of a School of Science be reserved, the deed must contain a condition securing the repayment of the grant to the Lords of Her Majesty's Treasury.

APPENDIX B.

SYLLABUS of the SUBJECTS in which EXAMINATIONS in SCIENCE are held by the DEPARTMENT OF SCIENCE AND ART.

SYLLABUS OF THE SCIENCE SUBJECTS.

THE following Syllabus has been prepared in order to afford candidates some guide to their reading; but it must be understood that the questions in the examination need not necessarily be on the specific points enumerated.

The examination is by paper, but oral examination may be resorted to. The examination in each subject is distinct. Mention is made of text-books solely to afford a candidate some assistance in selection, and a general idea of the scope of the examination, *and not at all to confine his reading to those works, or to assert that they are the best on the subjects they treat of.*

SUBJECT I.—PRACTICAL GEOMETRY.

Every one employed in any constructive art must acquire the power of representing on paper the forms and proportions of the work to be executed, whether it be of machinery, or of civil or naval architecture; and others, not immediately interested in construction require, in surveying, navigation, &c. a knowledge of practical as well as theoretical geometry of a more than elementary order.

Since it is essential to their utility that geometrical drawing should be accurate, the draughtsman must by practice and instruction be sufficiently acquainted with geometry to be able to apply its theorems with readiness and precision, and be sufficiently skilful in the use of his instruments and materials to ensure neatness as well as accuracy in execution: without these qualifications it is assumed that no one will present himself for examination in this subject.

But although prepared to this extent, the subject may be new to many, especially to those not acquainted with the application of arithmetic and algebra to geometry; it may therefore be necessary to apprise candidates, not only of what kind of knowledge will be expected, but of the form in which the examination papers will be drawn up.

Each paper will contain questions in both plane and solid geometry, about 12 in number, of which the candidate may select any number not exceeding eight, but to obtain a class in either course, at least half the questions answered must be from the solid geometry.

The candidate must also understand that he must strictly comply with the conditions of each question, and not imagine that by substituting others, provided they are analogous, he may obtain credit for his answer; strict impartiality would be violated by any such latitude.

First Stage or Elementary Course.

Plane Geometry.

1. Exercises in neatness and accuracy not requiring any advanced knowledge of geometry, *e.g.*, the construction of an irregular polygon when the length of its sides and magnitude of its angles are given.
2. The construction of plain scales.
3. Problems where straight lines only are concerned.
   - *a.* To divide a line in any given ratio.
   - *b.* To find a mean proportional, or third proportional to two, and a fourth proportional to three straight lines.
   - *c.* To divide a line so that the area contained by the segments may be of a given magnitude.
4. To construct a polygon of *n* sides—
   - *a.* Upon a given base.
   - *b.* To be of a given area.

5. To reduce a polygon of *n* sides to an equivalent triangle.
6. To draw circles to touch given lines or circles, or more generally to work problems where the straight line and circle are involved in various combinations.

Solid Geometry.

A general knowledge of the principles of Projection, and of the meanings of those terms which are in constant use, such as Plan, Elevation, Trace, &c.

Application of those principles, and illustration of the terms in the case of a simple solid resting on the horizontal plane.

Generally :—The elements of descriptive geometry carried so far as to enable the student to represent a solid by its plan and elevation :—

a. When the inclination of one face of the solid is given, and that of one edge of the face.

b. When the inclinations of two edges or two diagonals of the solid are given.

Second Stage or Advanced Course.

Plane Geometry.

1. The division of finite lines, or those lines produced under any of the conditions stated in the previous course, or under those of a more comprehensive character, such as harmonically, &c.
2. To determine by construction *lines* which shall be equivalent to magnitudes given by algebraical expressions, such as—

a. $\sqrt{m}$, $\sqrt{\frac{m}{n}}$, $\sqrt{\frac{1}{m}}$; (m and n being *numbers.*)

b. $\overline{a^2 \pm b^2}$, $\sqrt{ab}$, $\frac{\sqrt{ab}}{c}$, $\frac{\sqrt{m} \pm n}{k}$, &c., &c.

3. The construction of polygons from adequate conditions of sides, angles, area, or perimeter.
4. The division of polygons into *m* areas by parallel lines, or by lines drawn through a given point.
5. To draw circles to touch given lines and circles and to pass through two given points.
6. The construction of those plane curves which are required in practical arts (ellipse, parabola, cycloid, spirals, &c., &c.)
7. The construction of "scales" to drawings, to different units of measure, English and foreign, both plain and diagonal.

Solid Geometry.

a. A more searching examination in the principles and elementary problems of descriptive geometry.

b. Representation of a solid by its plan and elevation when,—
  1. A plane connected with the solid is given, and a line lying in that plane.
  2. Two lines connected with the solid are given.
  3. Two planes do. do.
  4. The height of three points of the solid are given.

c. Problems on the sphere, cone, and cylinder,—
  1. Representation of those solids in given positions and in contact.
  2. The determination of planes tangential to them.
  3. The determination of their sections by planes under given conditions.

d. The determination of the shadows of solid bodies bounded either by plane or curved surfaces, as cast by either parallel or converging rays of light.

e. Isometrical projection.

EXAMINATION FOR HONOURS.

Plane Geometry.

Candidates for honours will be required to make constructions relating to the contact of lines and circles with each other, and with other curves, requiring more knowledge of geometry and the power of making deductions, than is expected of other candidates; but the questions on these and other subjects will be of a practical utility in geometrical drawing. They must possess some knowledge of analytical geometry, so as to be able to construct lines or circles given by algebraical expressions referring to co-ordinate geometry of two dimensions, such as $\frac{x}{a}+\frac{y}{b}=1$; $x \sin A+y \cos A-p=0$; $(x-a)^2+(y-b)^2=r^2$, &c., &c.

They should also possess a sound knowledge of the properties of the conic sections, and of those other curves which admit of practical application, such as the epicycloid, evolute, &c.

Solid Geometry.

Problems will be given both in orthographic and radial (or perspective) projection. Amongst other subjects in the former of these must be studied that branch known as isometric projection, the solution of the cases of the spherical triangle by construction, the development of surfaces, and the intersection of curved surfaces. In the radial projection the student must show that he is acquainted with the principles of that method, and not merely be capable of "*putting into perspective*" a given solid.

The following books are recommended for study in Subject I. :—

For Theoretical Geometry.

Euclid's Elements of Geometry (School Edition), by R. Potts, 12mo., 4*s.* 6*d.* (London, Longman, 1868.)

Plane Geometry according to Euclid (Chambers' Series), by A. Bell. 12mo., 1*s.* 6*d.* (London, Chambers.)

Elements of Euclid (Weale's Series), by H. Law, 12mo., 2*s.* (London, Virtue, 5th ed., 1868.)

Manual of Euclid, by J. A. Galbraith and S. Haughton, 12mo., two parts, 2*s.* 6*d.* each. (London, Cassell, 1868.)

Principles of Modern Geometry, by J. Mulcahy, 8vo., 9*s.* (London, Simpkin, 2nd ed., 1862.)

Éléments de Géométrie, par Legendre, *avec Notes* par Blanchet, 8vo., 4*s.* (Paris, Didot, 11th ed., 1867.)

For Analytical Geometry:

Treatise on Plane Co-ordinate Geometry as applied to the Straight Line and the Conic Sections, by I. Todhunter, 8vo., 7*s.* 6*d.* (London, Macmillan, 4th ed., 1867.)

A Treatise on Conic Sections, by G. Salmon, 8vo., 12*s.* (London, Longman, 4th ed., 1863.)

Analytical Geometry of Three Dimensions, by G. Salmon, 8vo., 12*s.* (Dublin, Hodges & Smith, 2nd ed., 1865.)

Treatise on the Analytical Geometry of Three Dimensions, by J. Hymers, 8vo., 10*s.* 6*d.* (Cambridge, Deighton, 3rd ed.)

Éléments de Géométrie, par S. F. Lacroix, 8vo., 4*s.* (Paris, 1863.)

Analyse appliquée à la Géométrie des trois Dimensions, par C. F. A. Leroy, 8vo., 6*s.* (Paris, 1854.)

For Practical Geometry.

Practical Geometry, by Thos. Tate (Gleig's series), 18mo., 1*s.* (London, Longman, 1868.)

Elements of Geometrical Drawing, by Thos. Bradley, in two parts, oblong folio, each 16*s.* (London, Chapman & Hall, 1862.)

Practical Geometry, Linear Perspective, and Projection, by Thos. Bradley (Library of Useful Knowledge), 8vo. (London, Baldwin.)

Elements of Descriptive Geometry, by J. Woolley, text 8vo., plates 4to., 20*s.* (London, Parker, 1850.)

Elementary Geometrical Drawing, by S. H. Winter, in two 8vo. parts, 3*s.* 6*d.* and 6*s.* 6*d.* (London, Longman, 1861.)

Elementary Treatise on Descriptive Geometry, by J. F. Heather, (Weale's series), 12mo., 2*s.* (London, Weale, 1851.)

First Lines in Geometrical Drawing, by J. F. H. De Rheims, 8vo., 9*s.* (London, Williams & Norgate, 1865.)

**Traité de Géométrie Descriptive*, par J. Adhémar (with Atlas), 8vo. 20*s*. (Paris, 4th ed.)

Essais de Géométrie sur les Plans et les Surfaces Courbes, par S. F. Lacroix. (Paris, 7th ed.)

Traité de Géométrie Descriptive, par Lefébure de Fourcy, 2 vols., 8vo. (Paris, 1864.)

Traité de Géométrie Descriptive, par La Vallée (with Atlas), 4to., 15*s*. (Paris, 2nd ed., 1825.)

Traité de Stéréotomie, &c., par C. F. A. Leroy, *annotée* par E. Martelet, 4to. (with Atlas in folio). (Paris, 1866.)

Notes et Croquis de Géométrie Descriptive, par Bardin, folio, 10*s*. (Paris, 2nd ed., 1837.)

SUBJECT II.—MACHINE CONSTRUCTION AND DRAWING.

First Stage or Elementary Course.

The candidate will have to draw from sketches and written conditions the elementary constituent parts of all mechanism, such as wheels, cams, links, cranks, couplings, shafting, excentrics, cushions, or pillow blocks, but he must show his knowledge of machinery by supplying those details and that finish of execution that are intentionally omitted in the sketch. Any indication in the candidate's work that he has simply copied the sketch, only altering the scale, without understanding the principle of the mechanism, will invalidate his examination.

The essential condition of *symmetry* which characterizes all the works of man, that of being counterpart on each side of a central line or axis of symmetry, indicates the proper mode of drawing such objects; this principle in drawing, which may be called "copying by co-ordinates," must *be rigorously* observed, not only in the general forms but even down to the smallest details; unless it is so the drawing must be worthless, because inaccurate.

Second Stage or Advanced Course.

The candidate will have to represent combinations of the above-named elementary parts in machinery, as engines, lathes, drilling, planing machines, tools, clock-work, &c. He will have unfinished sketches of such combinations set before him, and he will be expected occasionally to show the parts in that different position which would be produced by the motive power acting on mutually dependent parts.

He will also occasionally be required to show, in skeleton outline, new combinations for effecting some changes of motion and velocity according to conditions.

He must also be able to represent parts of mechanism that admit of it in isometrical projection.

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* The most practical of all French works.

Examination for Honours.

The candidate will be required to make one or more drawings to scale of some machine intended to effect a prescribed operation, from a description, aided by sketches of those parts requiring especial explanation. These drawings he will be allowed to execute at his own home.

In addition he will have to answer in writing, and by sketches to scale illustrating his answers, questions on the general principles of mechanism, the modes of connecting the *power* with the *work*, the different modes of changing the velocity of the motions produced, and generally, analogous questions intended to ascertain his knowledge of machinery, and the means of representing it.

Works containing illustrations of engines, tools and machines are too numerous and well-known to require enumeration, but for the principles of mechanism, the following are particularly recommended :—

The Elements of Mechanism, by T. M. Goodeve, 8vo., 6*s.* 6*d.* (London, Longman, 2nd ed., 1865.)

Dynamics, Construction of Machinery, by G. F. Warr, 8vo., 9*s.* 6*d.* (London, Baldwin, 1851.)

SUBJECT III.—BUILDING CONSTRUCTION.

First Stage or Elementary Course.

The candidate will have to draw from unfinished sketches, as stated for the preceding subject, parts of constructions, such as walls, floors, roofs, partitions, arches, &c. The same remarks and injunctions apply here as for Subject No. II. In building construction the knowledge of the candidate will be shown by the bond of his brickwork, the framing and scantling of his timber, and joinery of his doors and sashes, and by the characteristic peculiarity of cast or wrought-iron structures.

Second Stage or Advanced Course.

The candidate will, in addition to more elaborate drawings of the same elementary parts, have to draw parts of viaducts, bridges, embankments, docks, &c. &c., and will have to answer, in writing, questions on the material, brick, stone, slate, timber, &c. used in such works.

In addition he will occasionally be called on to design parts of structures according to given conditions of use and material, but as the time allowed for the examination does not admit of any complicated drawing, he can only be expected to show his knowledge and taste by his drawing as far as it goes.

Examination for Honours.

The candidate will have to make one or more drawings of a building for some special use from description and specification, these drawings he will be allowed to execute at his own home. He will also have to

answer in writing, illustrated when directed by sketches to scale, questions on the following subjects :—

The different materials used in building, the mode of preparing them and their application in different parts.

The framing of timber in roofs, floors, partitions, stairs, &c.

The use of iron, cast or wrought; the construction of lattice girders in viaducts, bridges, &c.

The construction of brick, stone, or iron bridges, direct or oblique, suspension bridges, tunnels, drains, &c., &c.

Works containing examples of building construction are numerous. The following is recommended :—

Examples of Building Construction, by H. Laxton, in four parts, folio, each 2*l.* 10*s.* (London, 1856–62.)

SUBJECT III (ALTERNATIVE).—NAVAL ARCHITECTURE.

First Stage or Elementary Course.

Candidates for the elementary course will be required to possess sufficient knowledge of practical ship-building, to apply the various materials used for that purpose to the greatest advantage. Also to be able to make sketches, to scale, of the component parts of a ship's hull.

Second Stage or Advanced Course.

Candidates for the more advanced course will, in addition to that directed for the elementary course, be required to make detail and working drawings, showing a knowledge of the methods of combining the several parts of a ship's hull. Also to possess a knowledge of laying off on the mould loft floor.

Examination for Honours.

The honours examination will embrace questions relating to the calculation of displacement, in addition to that prescribed for the preceding courses; and the candidates will be required to make a drawing at home, comprising sheer, half-breadth and body plans, from data which will be furnished.

Neatness and accuracy in drawing will be insisted on.

The following works will comprise all that the teachers will require as text books, viz. :—

Rudiments of Naval Architecture, by James Peake (Weale's Series), 12mo., 3*s.* (London, Weale, 1851.)

Shipbuilding in Iron and Steel, by E. J. Reed, 8vo., 30*s.* (London, Murray, 1868.)

Directions for Laying-off Ships, by J. Fincham, 8vo., 25*s.* (London, Whittaker, 1840.)

Outline of Shipbuilding, by J. Fincham, 8vo., 31*s.* 6*d.* (London, Whittaker, 1853.)

Shipbuilding, Theoretical and Practical, edited by W. J. M. Rankine, folio, 84*s.* (London, Mackenzie, 1866.)

SUBJECT IV.—MATHEMATICS.

This subject is divided into seven stages. The examination in stages 1, 2, and 3 is taken on one evening; in stages 4 and 5 on another; and in stages 6 and 7 on a third.

A student may in any one year come up on all three evenings, but he may only take up one stage on each evening. The manner in which the subject has been divided under the several stages has been largely dictated by the requirements of the system of the Department as respects payments on results and method of examination. The sequence of the stages is therefore not to be considered strictly as a guide to the student's reading. There is no reason, for instance, why a student should not read the portion of the subject given under stage 4 at the same time or before that given under stage 3.

N.B.—Sufficient questions will always be given in the early portions of each stage to enable a student with a thorough knowledge of them by good answering to obtain a second class.

First Stage.

1. *Arithmetic generally.*—The performance of numerical calculations with accuracy and lucid arrangement, and explanation of the reasons of processes of a simple kind, may be demanded. This branch is mentioned not so much as a separate subject, but because wherever examples are given which involve *numbers*, the complete solution in figures should be given: that it may be ascertained by the examiner that the candidate can from formulæ in symbols deduce useful numerical results.

   Decimal fractions in all cases to be shown (not *vulgar fractions*).

2. *Geometry.*—The properties of lines, triangles, rectilinear figures, as far as they are treated in the 1st Book of Euclid.

   The examination questions in this subject will generally be set in the words of Simson's Euclid, but any logical proof of a proposed theorem, or accurate solution of a problem, will receive full credit if it be clearly evident that the candidate has apprehended the course of reasoning which preceded the proposition. Candidates should endeavour to draw good figures, and should as much as possible keep the demonstration on the same page with the figure.

3. *Algebra.*—Definitions. Simple rules. Greatest common measure and least common multiple. Indices. Involution and Evolution. Simple equations and problems producing them. Fractions.

Second Stage.

All the preceding subjects, with these additions :—

1. *Geometry.*—The relations of rectangles and squares to one another, and the properties of the circle, as far as they are treated in the 2nd and 3rd books of Euclid.

   As before defined, answers to questions on this part of Geometry may be given on any system which the student may have followed, provided the reasoning be clear and accurate.

2. *Algebra.*—Quadratic equations and problems producing them. The general properties of the trinomial of the second degree. Ratio. Proportion.

3. *Plane Trigonometry.*—Definitions. Modes of measuring angles, by degrees, grades, and circular measure. The goniometric functions, and the conversion of one into another. The meaning of contrariety of signs in trigonometry. Tracing of the goniometric functions in magnitude and algebraic sign through the four quadrants and when an angle is indefinitely increased. The arithmetical values of the goniometric functions of 30°, 45°, 60°, 75°, 90°, &c.

Formulæ for multiplication and division of angles: sine, cosine, tangent, &c., of $(A \pm B), 2A, 3A, \frac{A}{2}$, and $\frac{A}{3}$. Also of A and B in terms of sines and cosines of $\frac{A+B}{2}$ and $\frac{A-B}{2}$.

Logarithms.—Definition. Multiplication, Division, Involution and Evolution by logs. The use of logarithmic tables. Tables of proportional parts for numbers and angles. Modulus. Construction of logarithmic tables, and of tables of logarithmic sines, cosines, &c.

Triangles.—Formulæ for cosine of an angle of a triangle in terms of its sides. The relation between sines of angles and the opposite sides; sine, cosine, tangent, &c., of half an angle of a triangle in terms of sides, and of the sine of an angle. Area of a triangle. Solution of triangles. Diameters of circles inscribed in and circumscribed about a given triangle. Areas of regular polygons inscribed in and circumscribed about a given circle. Area of a circle. Description and use of vernier and theodolite and sextant. Heights and distances of inaccessible objects.

Third Stage.

All the preceding subjects, with these additions:—

1. *Algebra.*— Permutations and Combinations. Progressions. The Binomial theorem. Complete theory of indices. The Binomial theorem with any index. The multinomial and exponential theorems. Indeterminate equations. Method of indeterminate coefficients for expansion of series and resolution of fractions. Scales of notation. Logarithms and logarithmic series. Continued fractions. Series.

2. *Plane Trigonometry.*

Demoivre's theorem for any index. To express the sine, cosine, and tangent of the sum of any number of angles in terms of the sines, cosines, and tangents of the simple angles. To express the sine, cosine, and tangent of a multiple angle in terms of the powers of the sine, cosine, and tangent of the angle. To express the powers of sine, cosine, and tangent of an angle in terms of the sines, cosines, &c. of the multiple angle. Expressions for sine, cosine, and tangent of an angle in terms of the angle. The exponential expressions for the sine, cosine, and tangent of an angle, and resulting series. Solution of quadratic and cubic equations by trigonometry. Trigonometric series.

Or a student may, in place of the preceding analytical trigonometry, take up the elements of spherical trigonometry. Questions

will be given in both subjects, but in this stage the student will not be required to answer questions in both to obtain full marks.

Spherical Trigonometry.

Definitions of great and small circles, angles, and sides of spherical triangles. Relations between the angles and sides of supplemental triangles. The fundamental relations between the trigonometrical ratios of the angles and sides of every spherical triangle. Solution of right-angled, quadrantal, and other spherical triangles. The radii of their inscribed and circumscribed circles. The analogies of Napier and the formulæ of Gauss.

HONOURS.

In the subjects of the three preceding stages of elementary mathematics the principal theorems and their applications are indicated. A well prepared student will know of extensions of these theorems, and their employment in the solution of problems: to enable him to show enlarged reading there will be set on the same evening a paper headed, Examination for Honours.

The subjects being the same, there will be proposed in this paper questions which will be chiefly problems or theorems of the more difficult kind in each part. In algebra, the examples given will require more familiarity with algebraic transformations and include the doctrine of infinite series with extended use of the binomial and its dependent theorems. Properties of numbers. In geometry, the questions will chiefly be problems, or may require the aid of trigonometry as well as pure geometry for their complete answer: in trigonometry, besides questions which will exercise the student's ingenuity and test his familiarity with principles, the subject of angles greater than two right angles, and the relations between trigonometric ratios and all the angles which they indicate, will be included; trigonometric eliminations and transformations and the application of algebra to geometry must be familiar. Construction of the Trigonometric Tables. Formulæ of Verification. Proportional parts, and the calculation of logarithms of trigonometric ratios by series. The properties of regular polyhedrons treated by spherical trigonometry. (Analytical geometry or the equations of the line and circle will not be required, but chiefly the algebraic representation of geometrical ratios.)

The books in which elementary mathematics may be studied are too numerous to be mentioned, but as specimens of good and trustworthy treatises, which may be used with advantage by candidates who have little or no assistance, the following works by Mr. Todhunter may be recommended:—

Algebra for Beginners, 18mo., 2*s*. 6*d*.
(London, Macmillan, new ed., 1867.)

Algebra for the use of Colleges and Schools, 8vo., 7*s*. 6*d*.
(London, Macmillan, 4th ed., 1866.)

Trigonometry for Beginners, 18mo., 2*s*. 6*d*.
(London, Macmillan, 1866.)

Elements of Euclid, 18mo., 3*s*. 6*d*.
(London, Macmillan, new ed., 1864.)

Plane Trigonometry. 8vo., 5*s*. (London, Macmillan, 2nd ed., 1861.)

Spherical Trigonometry. 8vo., 4*s*. 6*d*.
(London, Macmillan, 2nd ed., 1863.)

More advanced students may study with advantage:—

Wood's Elements of Algebra, by T. Lund, 8vo., 12*s*. 6*d*.
(London, Longman, new ed., 1861.)

which contains an abundant supply of examples in Algebra.

Also,—
Arithmetic and Algebra, by Barnard Smith, 8vo., 10*s.* 6*d.*
(London, Macmillan, 7th ed., 1860.)
may be found useful.

Fourth Stage.

Plane Geometry.—Ratio and proportion. The similitude of figures. Proportional division of straight lines. The inscription of regular polygons in circles.

N.B.—A knowledge of the 4th and 6th Books of Euclid's Elements, supplemented by clear notions of the ratio and proportionality of commensurable, as well as of incommensurable magnitudes, will suffice. Correct demonstrations, however, derived from any other source will be accepted.

Solid Geometry.—The properties of straight lines and planes in space; their intersections, inclinations, parallelism, perpendicularity, &c.

Trihedral and polyhedral angles. Prisms, pyramids, and polyhedrons; their definitions, plane sections, similitude, &c.; their quadrature and cubature.

Elementary properties of the sphere, and of cylinders and cones with circular bases; their plane sections, tangent planes, surfaces, and volumes.

Descriptive Geometry.—Representation of points, straight lines, and planes, by projections and traces on two orthogonal planes. The use of auxiliary projections and rabatments. Graphic solutions of problems concerning straight lines and planes; their intersections, inclinations, &c. Changes of the planes of projection. Problems on trihedral angles.

Geometrical Conics.—Properties of the parabola, ellipse, and hyperbola deduced by pure geometry from definitions *in plano.*

Fifth Stage.

The preceeding subjects mentioned in stage 4, together with the following:—

Descriptive Geometry.—Problems concerning spheres, cylinders, cones, and simpler surfaces of revolution; their intersections by straight lines, by planes, and by one another; their tangent planes and normals, &c.

Spherical Trigonometry.—Definitions. Great and small circles. Angles and sides of spherical triangles. Relations between the angles and sides of supplemental triangles. The fundamental relations between the trigonometrical ratios of the angles and sides of every spherical triangle. Solution of right-angled, quadrantal, and other spherical triangles. The radii of their in- and circumscribed circles. The analogies of Napier and the formulæ of Gauss.

Co-ordinate Geometry.—Rectangular, oblique, and polar co-ordinates of a point, and transformations from one system of such co-ordinates to another.

Equations of straight lines, and the treatment of questions relative to their intersection, concurrence, inclination, parallelism, perpendicularity, &c.

Equations of circles, their tangents, and normals. Elementary properties of poles and polars relative to the circle. Questions

concerning the intersection of circles, and the determination of circles which satisfy given conditions.

The simpler forms of the equations of the parabola, ellipse, and hyperbola, as determined from various definitions of those curves. The equations of their tangents and normals. The principal properties of their diameters, axes, foci, conjugate diameters, asymptotes, poles, and polars.

Discussion of the general equation of the second degree referred to oblique or to rectangular co-ordinate axes.

Co-ordinate Geometry of three Dimensions.—Co-ordinates of a point referred to oblique or to rectangular co-ordinate axes. Direction-angles of straight lines. Inclination of two straight lines. Locus of points whose co-ordinates satisfy a given equation, or two given equations. Equations of planes and of straight lines. Determination of their inclinations, and of the conditions of their parallelism and perpendicularity. Treatment of questions concerning straight lines and planes.

Honours.

In the examination for honours, questions will be proposed whose treatment requires a more extended knowledge of the foregoing subjects, and an acquaintance with more general methods of investigation. In pure geometry, for instance, some knowledge of harmonic, as well as of anharmonic ratios, of the generation of conics by homographic rows of points and pencils of lines, and of the descriptive properties of these curves as thus deduced will be desirable. In co-ordinate geometry, again, opportunities will be given of exhibiting a knowledge of the use of abridged methods of notation, of homogeneous point-co-ordinates and line-co-ordinates, and of the modes of investigating thereby some of the simpler properties and singularities of higher plane curves.

In co-ordinate geometry of three dimensions a knowledge of the classification and fundamental properties of surfaces of the second order will be demanded.

Amongst the works on the subjects of the 4th and 5th stages which may be read with advantage, the following may be cited:—Dr. Woolley's Elements of Descriptive Geometry; Todhunter's Spherical Trigonometry; Geometrical Conics by Drew, Taylor, or Besant; Dr. Salmon's Treatises on Conics and on Higher Plane Curves; Townsend's or Mulcahy's Modern Geometry; Frost and Wolstenholme's Solid Geometry.

Sixth Stage.

Differential Calculus.—Definitions. Limits. Differential coefficients Differentiation of simple functions, of inverse functions. Successive differentiation of functions of one variable. Taylor's and Maclaurin's Theorems and their simpler applications. Determination of values of functions when indeterminate in form. Differentiation of a function of a function and of implicit functions. Maxima and minima of functions of one independent variable.

Applications of the preceding to the geometry of plane curves referred to rectangular or to polar co-ordinates. Tangents, normals, sub-tangents, sub-normals, asymptotes. Multiple and singular

points. Contact and curvature. Tracing of curves. Differential coefficients of arcs and areas of plane curves, and of the surfaces and volumes of solids of revolution.

Integral Calculus.—Meaning of definite and indefinite integration. Integration of the more frequently occurring functions. Integration by parts. Rational fractions. Formulæ of reduction.

Applications to the rectification and quadrature of plane curves referred to rectangular and polar co-ordinates, as well as to the quadrature of surfaces of revolution.

Seventh Stage.

Differential Calculus.—In addition to the subjects of the sixth stage, the following:—Differentiation of functions of two or more independent variables. Lagrange's and Laplace's Theorems. Change of independent variables. Expansion of functions of more than one independent variable. Maxima and minima of such functions. Elimination of functions.

Geometrical applications of the calculus. Involutes and evolutes of plane curves. Envelopes of curves and surfaces. Tangent planes and normals to surfaces. Tangents and normal planes to curves of double curvature. Differential coefficients of the arcs of such curves, as well as of the surfaces and volumes of solids.

Integral Calculus.—Double and triple integrals. Applications of the calculus to the quadrature of curved surfaces and the cubature of solids. Change of variables in a multiple integral. Definite integrals; their differentiation and simpler properties. Definitions and elementary properties of elliptic integrals and elliptic functions. Eulerian integrals. Gamma functions.

Differential Equations.—Their nature, origin, and classification. Integrable forms of differential equations of first order and degree. Integrating factors. Riccati's equation. The methods of integrating differential equations of first order, but not of first degree. Linear differential equations. Integration of them by symbolical methods when the coefficients are constant. Singular solutions of differential equations. Ordinary differential equations with more than two variables. Simultaneous differential equations. The nature and origin of partial differential equations. Integration of the simpler forms.

Geometrical applications to the theory of curved surfaces.

Calculus of Finite Differences.—Nature and object of the calculus. Definitions of its symbols and terminology. Differences of elementary functions. Expansion by factorials. Meaning of generating functions. Relations between successive values and differences. Differences of zero. Meaning of integration. Easy applications of the calculus to interpolation and the summation of series.

Honours.

In the examinations for Honours, the range of subjects will be almost the same; but the questions proposed will be of a higher order of difficulty. A more extended knowledge of the applications of the calculus to the theory of surfaces will also be demanded.

The following works may be read with advantage :—

Dr. Salmon's Analytic Geometry of three Dimensions.
Boole's Treatises on Differential Equations and on Finite Differences.
Todhunter's Treatises on the Differential, and on the Integral Calculus.

SUBJECT VI.—THEORETICAL MECHANICS.

First Stage or Elementary Course.

The student who takes up this course is expected to give clear and full statements of the principles of the science, and to show that he understands them by answering easy questions on their applications. These questions will not demand for their solution a knowledge of mathematics beyond the elements of algebra, mensuration, and geometrical constructions by scales and compasses. The formal proof of theorems will not be required except in the cases specified below :—

A.—*Statics.*

(1.) The composition and resolution of forces and the conditions of their equilibrium, viz., the parallelogram, triangle, and polygon of forces. Parallel forces. Equivalence of two couples. Composition of a couple and a force. The principle of moments.
(2.) Physical properties of solids; hardness, elasticity, tenacity.
(3.) Centre of gravity. Its position in the case of a straight line, parallelogram, circle, triangle, sphere, pyramid, and cone, of uniform density; and in the case of several heavy points.
(4.) Reaction of a fixed point or fulcrum. Equilibrium of a body capable of turning round a fixed point; levers; the balance, and its sensibility; the steel-yard.
(5.) Transmission of force through a rigid body and through a perfectly flexible thread. The single pulley. Simpler combinations of pulleys.
(6.) Reaction of smooth and rough surfaces; the limiting angle of resistance, or angle of repose; the coefficient of friction; the laws of friction.
(7.) Conditions of equilibrium of a body resting under the action of forces on a plane whether smooth or rough, horizontal or inclined; equilibrium of a wall sustaining an oblique thrust; buttresses.
(8.) Stable and unstable equilibrium.
(9.) Unit of work, and horse power; simple questions as to the working power of agents; the modulus of a machine.

B.—*Dynamics.*

(1.) Measure of time, distance and velocity—uniform or variable. The accelerative effect of a constant force, and particularly that of gravity. Relations between space, velocity and time in the case of the rectilinear motion of bodies whose velocities are uniformly accelerated. Composition of velocities.
(2.) Definitions of mass, momentum, moving force and of vis viva, energy or accumulated work. The laws of motion. The absolute unit of force.

(3.) Rectilinear motion of a body under the action of given forces; Atwood's machine; motion on an inclined plane, and in a circle; centrifugal force; time of small oscillation of a simple pendulum. Centre of oscillation of an oscillating body.

(4.) Impulsive forces; velocity after direct impact of spheres; transformation (or loss) of accumulated work in collision.

C.—*Hydrostatics and Pneumatics.*

(1.) Law of transmission of pressure through a fluid; pressure of a fluid against a plane area; the centre of pressure; equilibrium of a reservoir wall.

(2.) Pressure of a fluid on a body wholly or partly immersed. Specific gravity of a solid or liquid; and the simpler cases of its determination. Conditions of equilibrium of a floating body. The metacentre. Conditions of stability of a floating body.

(3.) Experiments which show that air is an elastic fluid; the Magdeburg hemispheres; the cistern barometer; Boyle's experiment. Relation between pressure, temperature, and volume of a gas.

(4.) Well known machines and the principles of their construction; the hydraulic press; the specific gravity balance; the hydrometer; Nicholson's hydrometer; the specific gravity bottle; the ordinary suction and forcing pumps; the syphon; the air pump.

The student should be able, if required, to prove :—

(*a.*) The rule for determining the *magnitude* of the resultant of two intersecting forces, assuming the rule for its *direction*.

(*b.*) The rule for determining the resultant of two parallel forces.

(*c.*) That the sum of the moments of two intersecting forces with reference to any point in their plane, equals the moment of their resultant with respect to the same point.

(*d.*) That two couples acting in the same plane will be in equilibrium if their moments are equal and of contrary signs.

(*e.*) The rule for finding the centre of gravity of a triangle.

(*f.*) The formulæ for uniformly acclerated rectilinear motion, viz. :—

$$v = V + ft. \qquad s = Vt + \tfrac{1}{2}ft^2. \qquad v^2 = V^2 + 2fs.$$

(*g.*) The formula for the *vis viva* of, or *work accumulated* in a moving body, viz., $\frac{1}{2}mv^2$ or $\frac{wv^2}{2g}$.

(*h.*) That the pressure of a fluid on a body wholly or partly immersed equals the weight of the fluid displaced, and acts vertically upward through the centre of gravity of the immersed part of the body supposed of uniform density.

Second Stage or Advanced Course.

The student who takes up the second or advanced course is expected to be able to prove the fundamental theorems of mechanics, so far as the subject is included in the elementary course, and to work somewhat harder examples; thus :—In the elementary examination he might be asked to explain what is meant by "centrifugal force," and to work an easy example on the formula $F = \frac{mv^2}{r}$; in the advanced examination he might be asked to prove this formula as well as to work a somewhat harder example. He is also expected to pursue the subject into some of its leading developments.

(1.) Proof and applications of the equations of equilibrium of forces acting in one plane.
(2.) Conditions of equilibrium of simple machines when the friction of the parts is taken into account. Inclined plane, wedge, screw, pulleys, bodies capable of turning round an axle of finite radius.
(3.) The principle of virtual velocities and its application to machines in a state of uniform motion. Dynamometers.
(4.) Motion on rough inclined and horizontal planes. Motion of projectiles.
(5.) Moment of inertia. Effective forces. D'Alembert's principle. Resultant of effective forces and work accumulated in the case of a body turning round a fixed line. The fly wheel. The compound pendulum.
(6.) Oblique impact. Centre of percussion. The ballistic pendulum.
(7.) Calculation of heights by barometer. The aneroid barometer.
(8.) Motion of fluids through orifices, pipes, and open channels.
(9.) Capillary attraction.

The following books are recommended for study; but it will, of course, be understood that all are not needed by any one student.

Elementary Treatise on Mechanics, by Wm. Whewell, 8vo., 9*s*. (London, Whittaker, 1847.)

Mechanics for Beginners, by I. Todhunter, 18mo., 4*s*. 6*d*. (London, Macmillan, 1867.)

Elementary Introduction to Practical Mechanics, by J. F. Twisden, 8vo., 10*s*. 6*d*. (London, Longman, 1867.)

Manual of Hydrostatics, by J. A. Galbraith and S. Haughton, 12mo., 2*s*. (London, Longman.)

Elementary Hydrostatics, by W. H. Besant, 12mo., 4*s*. (London, Bell and Daldy, 1867.)

Elementary Course of Mathematics, by Harvey Goodwin, 8vo., 16*s*. (London, Bell and Daldy, 6th ed., 1866.)

An Introduction to the study of Natural Philosophy, by C. Brooke, 12mo., 12*s*. 6*d*. (London, Churchill, 6th ed., 1867.)

Ganot's Experimental and Applied Physics, translated by E. Atkinson, 8vo., 15*s*. (London, Longman, 2nd ed., 1867.)

Examination for Honours.

The details of the course for this examination need not be specified, but it must be understood that the student should be prepared to answer questions on every branch of the subject as usually taught in the higher classes in colleges. In addition to the careful study of the usual text-books, such as Todhunter's *Analytical Statics*, Routh's or Griffin's *Rigid Dynamics*, Besant's or Miller's *Hydrostatics*, the student will find it very useful to study some work in which the subject is treated from a somewhat less exclusively mathematical point of view, such as the first 19 chapters of Jamin's *Cours de Physique*, Morin's *Notions fondamentales de Mécanique*, the first division of Thomson and Tait's *Natural Philosophy*, &c. The applications of abstract mechanics to questions of construction, &c. can be studied in Moseley's *Mechanical Principles of Engineering and Architecture*, and in Rankine's *Applied Mechanics*. It must be borne in mind that the study of the higher branches of mechanics can only be attempted with profit when it is preceded by a thorough knowledge of the elements; of so much, for instance, as is comprised in the first and second courses.

Particulars of the text-books required for this course are given below.

Analytical Statics with numerous examples, by I. Todhunter, 8vo., 10*s*. 6*d*. (London, Macmillan, 3rd ed., 1866.)

Dynamics of a System of Rigid Bodies, by E. J. Routh, 8vo., 10*s*. 6*d*. (London, Macmillan, 1860.)

Treatise on the Motion of a Rigid Body, by W. N. Griffin, 8vo., 6*s*. 6*d*. (London, Parker and Son, 1847.)

Treatise on Hydro Mechanics, by W. H. Besant, 8vo., 10*s*. 6*d*. (London, Bell and Daldy, 2nd ed., 1868.)

Elements of Hydrostatics and Hydrodynamics, by W. H. Miller, 8vo., 6*s*. (Cambridge, Deighton, 4th ed., 1850.)

Mechanical Principles of Engineering and Architecture, by H. Moseley, 8vo., 24*s*. (London, Longman, 1855.)

Manual of Applied Mechanics, by W. J. M. Rankine, 12*s*. 6*d*. (London, Griffin, 4th ed., 1868.)

Cours de Physique de l'Ecole Polytechnique, par J. Jamin, 3 vols., 8vo., 1*l*. 8*s*. 6*d*. (Paris, Mallet-Bachelier, 2nd ed., 1866–68.)

Leçons de Mécanique pratique, Notions fondamentales de Mécanique et données d'expérience, par A. Morin, 5 plates, 8vo., 6*s*. 6*d*. (Paris, Hachette, 3rd ed., 1860.)

SUBJECT VII.—MECHANICS AS AN ART OR APPLIED MECHANICS.

The subject of applied mechanics is considered as embracing generally the art of fashioning materials into various definite forms, and of arranging these definite forms under such combinations that on the application of force a certain and invariable result will be obtained, including also the adaptation of forms and materials so that they afford the maximum resistance with the minimum of quantity.

This syllabus is arranged for three classes of candidates; the first is elementary in its character, and may be considered as a stepping-stone to the second or more advanced class; it is intended for the guidance of the first or elementary class of candidates, who will be expected to have a fair knowledge of most of the branches enumerated, and to be able to give a precise and satisfactory answer on any of them, or to make clear, well-drawn hand sketches where such may be necessary for explanation.

The second part is intended for those in the more advanced class, who will be expected to have a thorough knowledge of all the subjects referred to in the syllabus for the elementary class, and, in addition, to have a fair understanding of the application of the principles in actual practice.

The third part is intended for candidates coming forward for "Honours examination," who will be expected to have a complete knowledge of the questions referred to in the two former parts of the syllabus, and, in addition, to have some acquaintance with the higher theoretical principles that are required for the close investigation of the foregoing or more practical part of the subject.

As the chief object of these examinations is to foster the education of young men for the practical duties of life in connexion with the engineering and manufacturing industries of the kingdom, it is intended that the examination in applied mechanics shall be in accordance therewith so far as may be practicable.

First Stage or Elementary Course.

Candidates in the first stage will require to know the more prominent properties of materials used in the mechanical arts; the different natures of wood that are in common use; the leading characteristics of cast iron, wrought iron, and steel; copper, tin, and zinc; brass, gun metal, muntz metal, and other similar compounds used in machinery; leather, gutta-percha, and vulcanized india-rubber, as employed for mill bands or pump purposes.

The general principles on which various materials are made into form, by casting, forging, compressing, drawing, cutting, &c.; the purposes for which different materials are commonly employed and the reasons which determine their selection; the modes of uniting and combining the several parts of structures by screw bolts, rivets, keys, cotters, wedges, soldering, &c.

The general principles of mechanical work; units of work as distinguished from other units; unit of a horse power; the calculation of mechanical work; work of living agents, wind, water and steam, neglecting friction or other conditions.

The principle and construction of simple machines by the combination of several parts; levers, pulleys, wheel and axle, inclined planes, the wedge, screws. Likewise the more complex machines that are in common and extensive use; cranes that are worked by hand; the working headstock of a common turning lathe; the cornmill; the time movement of an ordinary clock, &c.

The more common methods of transmitting motion by simple elementary parts or apparatus in extensive use; toothed wheels considered as spur, bevil, mitre, worm, mangle, and eccentric; friction wheels, revolving shafts, couplings, bearings, drums, mill bands, fast and loose pulleys, conical pulleys for altering the rate of motion, clutches (forked and frictional); eccentric motion, camb motion, crank motion, reversing motion, intermittent motions; the pendulum, nature of a *governor*, cylinder and piston, slide valve, stuffing box, gland, fly wheel, safety valve, and other similar details.

Expenditure of work through the agency of machines; effect of reducing or increasing velocity; loss arising from friction. Calculating the power of simple machines, cranes, pulleys, screws, and their relative conditions in regard to friction; their applicability for different purposes.

General properties of fluid pressure, water pressure in tanks and on flood gates; weight of water; water power; power required to raise water; the principle of water forcing pumps and the Bramah press; hydraulic pressure, accumulator, pressure gauge, air pressure, weight of air, elasticity of air, air pump, barometer, aneroid, vacuum, vacuum gauge, syphon, and diving bell; action of the common household pump; condensation of air; the air gun; the balloon principle; effect of air pressure as regards sensible temperature, and contrary effect when liberated; Smith's bellows principle, and action of a blowing fan; principle on which chimneys produce a current of air; the blast pipe of locomotives; quantity of air required to produce the perfect combustion of fuel.

Three conditions of ice, water, and steam; sensible and latent heat; the several properties of steam taken advantage of in steam engines; action of steam in cylinder of steam engine; expansion of bodies by heat; the thermometer; heat conducting power of bodies; the advantage of covering steam pipes and cylinders with felt and other substances; principle of heating buildings by steam; water heating apparatus; difference between the evaporation of salt and fresh water.

Manufacturing as compared with making; principle of production by taking the pattern or figure from a copy; printing, coining, turning, and

planing; smiths' swages, and founders' patterns; conditions of a straight edge and of a true surface; the true spindle of a lathe; principles of an instrument for cutting, its penetration and strength. The action of the punch, file, saw, and grinding stone. The effect produced by plunging red hot steel into cold water; nature of tempering steel.

Strength of cast iron, wrought iron, and steel in regard to tenacity and compressibilty. Strength of a simple wooden beam under different conditions of support; supported at the ends and loaded in the middle; uniformly loaded. Nature of a neutral axis in beams; strength of beam as affected by length, depth, and thickness. Advantage of making cast-iron pillars hollow. Relative strength of chains to diameter of iron out of which they are made.

Second Stage or Advanced Course.

Candidates in the second stage require a general knowledge of the different kinds of timber used in the arts, including strength and special properties; the several metals employed in engineering, their nature, preparation, and special properties, including tenacity, compressibility, hardness, brittleness, density, malleability, ductility, elasticity, weight, specific weight, &c.

General principles of the art of founding; construction of patterns; essential conditions of a mould for the reception of liquid metal, &c. Chilled castings and malleable castings. Principles of smithing or forging; nature of welding; production of form by welding, upsetting, drawing down, punching, and bending. Steel management; temper of steel for different purposes; effect of cooling in oil, and case hardening. Principle of rolling iron, wire drawing, bolt and rivet making. Shearing machines, steam hammers, and drop hammers; principle of the bolt and nut. Rivetting by hand and by machinery. Nature of soldering; the essential principles involved.

Machines considered as agents for changing power from the unsuitable to the required condition, not creating power. Nature of friction; reduction of friction by lubricants; coefficients of friction of different materials and surfaces; laws of friction; friction as affected by the mode of transmitting power through machines; a given quantity of power expended under any conditions of velocity.

Lever principle applied in the arts; beams of steam engines; beams variously arranged as regards fulcrum. Cranes, crabs, or other machines for lifting where power is accumulated by toothed wheel gearing. The friction of cranes; arrangements to avoid friction; friction of block and tackle, ropes, and chains.

Inclined plane in the arts; friction of the inclined plane, as in the key for fixing parts of machinery; friction a virtue. Power required to draw materials up inclined planes. The screw as a fixing agent, and as an instrument for compressing, adjusting, dividing, and manipulating.

Regularity of motion necessary; power irregular, work done irregular. Use of the fly wheel; its power as depending on weight and velocity; efficiency depending on position; the fly wheel as an agent for storing power, as in the rolling mill and punching machine; fly wheel not increasing power. Steam hammers; springs considered as accumulators of power; means for setting machinery in motion gradually. Steam, water, fast and loose pulley; efficiency of friction clutches depending on an accumulation of small efforts; lowering goods with friction breaks on cranes, &c. Machinery which is regular in regard to time; theory of the pendulum and the governor; peculiar construction of water-wheel governors; comparison of the governor with the pendulum.

Machinery considered in relation to its three essential parts of the

receiving power, the so-called prime mover, the intermediate mechanism for conveying and modifying, the part which performs the required operation. The term "work" as expressing applied power, pressure, or distance. Mode of calculating the power of different kinds of machinery. Use of dynamometers, indicators, &c.

Machinery construction; strength with lightness; correct fitting of moving parts; principles that govern the formation of teeth of wheels. Advantage of wood and metal working together; velocity as depending on relative diameters; advantages derived from high velocities; construction of modern shafting and gearing generally, including all details. Best materials for bearings, both hard and soft; proportion of length to diameter; anti-frictional arrangements; broad surface advantages, &c.

Conveying work or power, by shafting or by endless bands; through a tube in the condition of compressed air, by water or steam; convenience in each case determining selection; respective advantages of the several methods. The leather band as an agent; its coefficient of friction, adhesion, adaptability for changing velocity, and efficiency as depending on velocity; various adaptations to convey power in different directions.

The advanced candidate should have precise knowledge of the different elementary mechanical contrivances for modifying motion. From fast to slow by the worm wheel, and by double and single and frictional ratchets. For changing from rotary into rectilinear or the reverse, by rack and pinion; by the crank motion as in steam engines, and the opposite, as in slotting machines; by an endless groove on cylinder; by screw with reversing motion. The mangle wheel principle, and three bevil wheel arrangement; open and crossed bands, with two fast and two loose pulleys. Contrivances for giving variable motion, such as the leather wheel on disc surface, the various forms of camb by which any motion may be obtained, &c.

Machinery construction considered with reference to form, proportion of parts, and strength of parts as determined by necessity; use of cast iron, limited by want of uniformity in cooling, of wrought iron by difficulty of fashioning into intricate form, and of bronze by cost; strength of revolving parts inversely as motion. The lever principle; advantage of fixing parts at both ends applied to pillars; risk of fracture reduced; advantages derived from hollow framing; stiffening by ribs; comparative cost of both systems. Form of parts as determined by the tenacity and compressibility of the materials, applied to beams; in machinery varied by other conditions causing inconsistencies of proportion; great advantage of rigid framing.

Strength of hollow cylinders not in proportion to mass; cylinder of hydraulic press, gun, &c.; each layer of lamina under tension affords greatest strength, the practical difficulties; system of building up cylinders by successive hoops, put on by pressure or by shrinking, each layer being under different tension.

The leading fundamental principles of pneumatics, with practical applications; apparatus for producing a current of air; blowing engines, and blowing apparatus generally; the fan principle, both in blowing and exhausting, with applications; mechanical ventilation of mines and buildings, as for example in cotton mills, and in the grinding processes.

Atmospheric elasticity and its applications in the post office atmospheric tube, flour mills, mines, atmospheric railways, engines working by compressed air; air vessels in pumping apparatus; cartridge, seamless bag, and envelope machine; button making; coal hewing; rock boring; dessicating timber.

The laws of hydrostatics and hydraulics, and their applications in the arts; ancient methods of raising water, modern steam pumping machinery; lifting, forcing, plunging, bucket, horizontal, vertical, centri-

fugal, screw, scoop, wheel, and other pumps; water supply to towns; sewerage pumping machinery; the syphon on a large scale; Middle Level drainage; Montgolfier water ram. Difference of friction with large or small pipes; flow of water through pipes; friction of mains; flow as affected by rust; high-pressure water machinery; provision for non-elasticity; working from high reservoir; water-pressure engines; character of pumps; boiler proving; application to hydraulic press, cranes, lifts, dock gates, capstan and bridges; rocket manufacture; water engines, &c.

Water as a motive power; water wheels and water engineering; making the most of fall; construction of dam, sluices, and canal; situation for factory; Fairbairn's water wheels, mode of transmitting the power; reduction of friction; modes of ascertaining the quantity of water available. Water power, nominal and actual; water acting by impulse and by weight; conditions determining greatest effect; manipulation of sluice by governor; water wheels coupled to steam engines, necessary provision; treatment of tidal water.

Gravitation water-pressure engines; various systems of construction of turbines and leading conditions to give best result; inherent defects, for high falls and for low falls; comparison with water wheels; useful effect, first cost, convenience and expense for repair; working in tail water; advantage from high velocity; equilibrium.

Engines deriving their power from heat, steam, hot air, and gas; the source of heat; the equivalent of work in heat; loss of heat by present arrangements; the heat contained in fuel. Steam boilers, in stationary, marine, and locomotive engines; materials for construction; strength of boilers for internal pressure; external pressure of elliptical or flat surfaces; boiler feeding by pumps and injectors; prevention of incrustation; explosion of boilers; general economy and management. Stationary, marine, locomotive, condensing, non-condensing, and working expansively steam engines; leading conditions that determine waste and economy; the principle of valves, slide, equilibrium, &c.; steam hammer construction.

Machine tools for wood: the principle of copying as developed in sawing, planing, morticing, tenoning, drilling, shaping, carving, and moulding gunstocks, &c. Machine tools for metal; combining the self-acting principle with that of the sliding rest; shape or form derived by transfer from a copy contained in the apparatus; the dead centre principle; modern lathes; machines for planing, slotting, drifting, shaping, screwing, wheel cutting, rifling, and drilling; advantage derived from introduction of true surface, and correct measurement of parts; measuring machine; principles which determine the proper speed for cutting wood and metal; machines that act more by force than by cutting, as the shearing and punching machines; the principle of circular shears, &c., various forms of screwing apparatus; advantage derived from uniform system of screws.

General machinery: hand, steam, travelling, and portable cranes; derrick and sheer legs. Paper manufacture, printing, and coining. Textile manufactures; carding, spinning, weaving, and sewing. Measuring. Turntables and weighing machines. Agricultural machinery and engines; steam plough; reaping and thrashing machines; modern grinding mills; traction engines.

Adaptation of form and material for maximum resistance; cast iron and wrought iron beams; tubular girders; construction of roofs, timber bridges; suspension bridges; iron pillars. Construction of tanks, strength of cast-iron pipes; hydraulic press cylinders; relation of ultimate strength of materials to limit of elasticity and safe working load.

Examination for Honours.

The foregoing syllabus will sufficiently indicate the nature of subjects that will form the basis for the Examination in Honours in Applied Mechanics. It will be expected however, that the candidate in addition to being able to give an intelligent answer to the various questions, and to make hand sketches of such parts as may be required, shall be thoroughly grounded in the laws of nature, so far as they relate to the philosophical and mathematical principles on which the various branches of applied mechanics are founded, and the candidate should not only be familiar with the formulæ, but should be able to refer back to the data from which they are derived.

The following are recommended as text books :—

The Elements of Mechanism, by Thomas Baker, 8vo., 2*s*. 6*d*. (London, Weale, 3rd ed., 1867.)

Elementary Introduction to Practical Mechanics, by J. F. Twisden, 8vo., 10*s*. 6*d*. (London, Longman, 1867.)

The Elements of Mechanism, by T. M. Goodeve, 8vo., 6*s*. 6*d*. (London, Longman, 2nd ed., 1865.)

Railway Locomotives, by D. K. Clark, 2 vols., 4to., 70*s*. (Glasgow, Blackie, 1860.)

Treatise on the Steam Engine, by J. Bourne, 4to., 42*s*. (London, Longman, 5th ed., 1861.)

Railway Practice, with Plans and Details, by S. C. Breeze, 4 vols., 4to., each 52*s*. 6*d*. (London, Atchley, 1848.)

Camus' Treatise on the Teeth of Wheels, by Hawkins, 8vo., 5*s*. (London, Spon, 3rd ed., 1868.)

Elementary Principles of Carpentry, by Thos. Tredgold, edited by Barlow, with 53 engravings, 4to., 2*l*. 2*s*. (London, Lockwood, 1868.)

Inquiry and Experiments on the Tensile Strength of Wrought Iron and Steel, by D. Kirkaldy, 8vo., 18*s*. (London, Simpkin, 2nd ed., 1866.)

Useful Information for Engineers, by W. Fairbairn, 3 vols., 8vo., 10*s*. 6*d*. each. (London, Longman, 1864.)

Turning and Mechanical Manipulation, by C. Holtzapffel, 3 vols., 8vo., 2*l*. 10*s*. (London, 1866.)

Engineer's and Machinist's Assistant, 2 vols., 4to., 4*l*. 4*s*. (Glasgow, Blackie, new ed., 1860.)

Engineer and Machinist's Drawing Book, 4to., 2*l*. 2*s*. (Glasgow, Blackie, new ed., 1868.)

Useful Metals and their Alloys, by Fairbairn, Scoffern, &c., 8vo., 7*s*. 6*d*. (London, Houlston, 4th ed., 1866.)

Moulders' and Founders' Pocket Guide, by F. Overman, 12mo., 4*s*. 6*d*. (Philadelphia, 2nd ed., 1866.)

On the Management of Steel, by G. Ede, 8vo., 5*s*. (London, Tweedie, 4th ed., 1866.)

In addition all the books bearing on this subject in *Weale's Series* may be recommended.

SUBJECT VIII.—ACOUSTICS, LIGHT AND HEAT.

First Stage or Elementary Course.

Questions will be confined to the following subjects:—

Acoustics.

The pupil ought to have a perfectly clear notion of the manner in which a *wave* is propagated.

He ought to know what is meant by the terms density and elasticity as applied to air and other bodies, and how heat and cold affect the density and elasticity of air.

He ought to be able to describe simple experiments to prove that air possesses both weight and elasticity. He ought to understand the law of Marriotte, the construction and use of the air pump, and what occurs when a sounding body is placed in a space from which the air has been withdrawn.

He ought to be taught to see the play of elasticity in the propagation of a sonorous wave through air, and to have a clear mental image of the condensation and rarefaction which make up such a wave. He must, of course, be able to distinguish between the motion of a wave and the motion of the particles which at any moment form the wave.

He ought to know how the velocity of a wave is affected by a change of density, by a change of elasticity, or by a change of both.

He ought to know the velocity of sound in air of the freezing temperature, and also the amount of augmentation of velocity for every degree of the thermometer. The temperature of the air being given, he ought to be able to calculate the velocity of sound through it, and the velocity of sound being given he ought to be able to calculate the temperature of the air.

No doubt or confusion must rest within his mind regarding the meaning of the terms *velocity*, *intensity*, and *amplitude*. He ought also to know the relation of the two last to each other.

He ought to know the laws of the reflection of sound by tubes and mirrors, and to be able to apply his knowledge to the explanation of echoes.

The law of inverse squares as applied to sound, ought also to be explained to the pupil.

He ought to be able to figure mentally the propagation of a sound-wave through solids and liquids as clearly as through air; to know the velocity of sound through water, and to be able to infer from this the relation of the density of the liquid to its elasticity.

He ought to know how the velocity of sound through air has been determined, and to be well exercised in the calculation of distances by means of light and sound.

The pupil ought to know the physical difference between music and noise, and to be able to state the conditions on which the pitch and the intensity of musical sounds depend. He ought also to be able to describe various methods of producing musical sounds.

He ought to have clear ideas of the *length* of a wave, and of the *time* of a vibration. The length of a wave at a definite temperature being given he ought to be able to calculate the time of a vibration, and the time of a vibration being given he ought to be able to calculate the length of the wave.

He ought to be able to describe a method of determining from the pitch of a sound the number of vibrations per second which produce it.

He ought to know the structure of the drum of the ear, including the membranes that close it, and the bones that cross it.

He ought to know the laws of the vibration of strings, and to understand the use of sound boards in stringed instruments.

He must have a clear notion of the formation of *nodes* upon a string, by the coalescence of direct and reflected waves.

He ought also to know the laws of vibration of columns of air in both stopped and open pipes. The exact condition of the air when the fundamental notes of each class of pipes is sounded, ought to be clearly present in the pupil's mind.

The cause of beats in music ought also to be explained to the pupil, and he ought to know the range of the human ear for musical sounds.

Light.

Before entering upon the subject of light, the teacher will have been careful to make his pupil perfectly familiar with the conception of waves of sound impinging upon the tympanic membrane, and the transmission of the tremor thus produced to the auditory nerve. He need not attempt to enter upon the details of this transference to the nerve, but up to the tympanic membrane, and including it, the idea formed by the pupil of sound waves and their action must be perfectly distinct. In all cases an image must exist corresponding to the teacher's words.

He must understand that the sensation of light is caused by something that hits the optic nerve. That this something, whatever it be, passes through the humours of the eye to reach the nerve behind. The conception of light known as the emission theory can afterwards be made clear to the pupil. According to this theory a ray of light would be a train of these particles.

That a ray of light proceeds in a straight line must be made known to the pupil. In connection with this point the inversion of objects by rays passing through small apertures must be explained.

The mode of determining the velocity of light by the eclipses of Jupiter's satellites must be explained to the pupil.

The law of inverse squares must be illustrated.

The cause of shadows and penumbræ must be explained.

The mode of determining the relative intensities of two lights by means of the "shadow test" must be explained.

The reflection of light from plane mirrors must be explained.

The pupil's attention must be drawn to the lateral inversion of objects by plane mirrors. He must know how the distance of an image behind a looking glass is affected by a change of position of the glass in a direction perpendicular to its own planes.

The relation between the angular velocity of a reflected ray and the mirror that reflects it must be explained to the pupil. The multiplication of images by angular mirrors ought also to be explained, and from it the appearances of the kaleidoscope rendered intelligible.

The formation of images by a concave spherical mirror ought to be explained to the pupil. The axis, principal focus, and centre of the mirror are to be pointed out. Beginning with a luminous point placed beyond the centre, and upon the axis, the successive positions of the image of this point during its motion along the axis from a great distance through the centre through the principal focus, up to the surface of the mirror itself must be determinable by the pupil. He will then be taught to determine the position of the images of points not placed on the axis. Objects of sensible dimensions, such as the pupil's own body, must then be substituted for points. (The teacher will avail himself of such simple apparatus as he can command in the explanations

here referred to; a silver spoon, if he possesses nothing better, will be useful).

Real and *virtual foci* are to be defined.

The "aberration" of a large spherical mirror must be explained.

The refraction of light must be explained. By means of a simple geometrical construction the meaning of the "index of refraction" may be explained to the pupil without the introduction of the term "sine."

It must be clearly explained that an object looked at with a single eye appears more near the greater the divergence is of the rays which reach the eye from the various points of the object. From this it will be inferred that a lake or river, the bottom of which is visible, appears more shallow than it really is.

Various simple, but instructive illustrations of the effects of refraction will occur to the teacher, such, for example, as the rendering of a coin visible by pouring water into a basin, and the apparent bending of a straight stick thrust obliquely into water.

The circumstances under which *total reflection* occurs must be clearly explained to the pupil.

The power and action of lenses must be explained; the teacher will define the *principal focus* of a lens. As in the case of a spherical mirror, he will begin with a luminous point, determining the position and character of its image, while it moves from a great distance up to the lens itself. He will pass from points to objects of sensible dimensions, and show how the position of the image of every point of such object may be determined.

Here also *real* and *virtual foci* are to be explained.

The explanation of the magic lantern is then to be introduced.

It would add much to the efficiency of the instruction if the teacher would illustrate the points here referred to by common spectacle lenses, provided he has nothing better.

The pupil in the first class is also in a condition to know what is meant by the spherical aberration of a lens.

He must understand the optical structure of the eye, be able to give a clear account of the conditions of distinct vision, and of the causes and remedies of long and short sight.

He ought to be acquainted with the fact that impressions persist upon the retina, and to know what is meant by irradiation.

He ought to know the principles of binocular vision, and to clearly comprehend how the impression of solidity is produced by the stereoscope.

He ought to be made acquainted with the composite character of white light; and to be able to describe an experiment by which such light may be resolved into its coloured constituents.

He ought to understand the doctrine of colours as far as they are produced by absorption.

And he ought to understand the meaning of *chromatic aberration*.

Finally, it is to be stated to the pupil that according to our best knowledge the sensation of light is not produced by the impact of little particles darted out from luminous bodies; but that it is caused in a manner somewhat similar to the sensation of sound, namely, by the successive shocks of minute waves against the retina.

Heat.

The pupil should know the general effect of heat upon the volumes of bodies, and should be able to describe experiments illustrative of the expansion of solids by heat. He ought also to have an idea of the almost irresistible force of this expansion.

He ought to understand with perfect clearness what is meant by the *coefficient of expansion*, linear, superficial, and cubical.

He ought to know by heart the coefficients of expansion of gold, silver, platinum, iron, and glass; and the reason why it is possible to fuse platinum wire into glass without fracture on cooling.

He ought to know the principle of Breguet's metallic thermometer, and to be made acquainted with some of the precautions which changes of volume by heat and cold render necessary in the arts.

He ought to be able to describe and explain the gridiron pendulum.

He must be able to describe the construction and explain the use of of the mercurial thermometer; the scales of Fahrenheit, Celsius, and Reaumur must be known to him, and he must be able to convert immediately the readings of any one of them into those of the other.

The dependence of the boiling point of water upon external pressure ought to be known, and the pupil must be able to give illustrations of this dependence.

He ought to know by heart the coefficients of expansion of water, alcohol, and mercury.

The pupil must be well acquainted with what is called the *maximum density* of water, to state at what temperature it occurs, and to point out its effects in nature.

He ought to be acquainted with the change of volume which occurs when water passes from the liquid to the solid state, and to apply his knowledge to the bursting of water-pipes in frosty weather. He ought to be acquainted with the fact that expansion on solidification is not a property peculiar to water.

He ought to be able to describe experiments which shall illustrate the expansion of gases. The principle and action of the fire-balloon ought to be explained to the pupil.

The general principles of ventilation ought also to be known to him, and also the sun's action in the generation of winds. He ought to be able to explain the Trade Winds.

The constancy of the coefficient of expansion of gases ought to be pointed out, with the small deviations from the general rule exhibited by carbonic and sulphurous acids. The chemical and physical character of these gases ought to be known to the pupil.

He ought to know the constitution, chemical and physical, of aqueous vapour, and how it is diffused in the atmosphere. He ought to know the meaning of the term *saturated* as applied to air charged with vapour.

The effect of expansion in chilling air ought to be known to the pupil, and also the condensation of the aqueous vapour diffused through the air in consequence of such a chill.

He ought to be able to see the application of this knowledge to the explanation of clouds and rain.

He ought to have a perfectly clear idea of what is meant by *specific heat* or *capacity for heat*, and to be able to describe the calorimeter of Lavoisier and Laplace. He ought to know by heart the specific heats of water, alcohol, mercury, iron, and lead; and to be made aware of the influence which the high specific heat of water exercises upon climate.

He ought also to be intimately acquainted with the facts covered by the term *latent heat*. Taking a block of ice at a temperature below the freezing point, he ought to be able to describe with perfect accuracy what occurs when the temperature of the substance is raised until it liquifies, boils, and is converted into vapour.

The latent heat of water, as expressed on the Fahrenheit and centigrade scales, ought to be in the pupil's memory.

The cold of evaporation and its effect in freezing water in the cryophorus ought to be known to the pupil.

He ought to be exercised in calculations on the changes of temperature due to the mixture of steam and water in various proportions.

The pupil ought to know what is meant by the *conduction* of heat, and must be able clearly to distinguish it from the distribution of heat by *convection*. He ought to know by heart the numbers expressing the relative conductivity of gold, silver, copper, iron, and lead.

He ought to be acquainted with the low power of conduction of organic substances; to know the effect of mechanical texture on the transmission of heat, and to explain the function of clothes in preserving the body from cold.

He ought to be acquainted with the character and phenomena of combustion; to be able to explain the chemical actions which occur in the combustion of coal and of ordinary gas, and to explain the manner in which a candle flame receives its supply of combustible matter.

The combustion of the diamond and Newton's prediction regarding it ought to be known to the pupil. That animal heat is due to slow combustion ought also to be made known.

The structure of an ordinary gas flame ought to be pointed out, and the cause of the difference between this flame and that of a Bunsen's burner explained.

The pupil must be acquainted with the general phenomena of *radiant heat*. The similarity between the phenomena of radiant heat and those of light, as regards reflection and refraction, ought to be known to the pupil.

The different powers possessed by different substances to radiate heat ought to be pointed out, and this knowledge ought to be applied in explaining the striking fact that the cooling of a vessel may, under certain circumstances, be hastened by surrounding it with flannel.

The reciprocity of radiation and absorption ought to be known to the pupil.

He ought also to know what is meant by the term *diathermancy*, and to be able to point how this property is manifested by different bodies.

Second Stage or Advanced Course.

Questions may be set in all Subjects enumerated under the Elementary Stage, and in addition on the following topics:—

Acoustics.

The second course in acoustics includes an intimate knowledge of all the subjects mentioned in the first. In addition to this a knowledge of the following subjects will be required:—

The augmentation of the velocity of propagation of a wave of sound through air by the condensation and rarefaction of the sound wave itself.

Harmonic tones, their generation and their function in music.

The laws which regulate the transverse vibrations of rods.

The vibrations possible to a tuning fork, a disk, and a bell.

The formation of Chladni's figures.

The laws which regulate the longitudinal vibrations of strings and rods. By a comparison of the notes emitted by a rod and a column of air the pupil ought to be able to determine the relative velocities of sound through both substances.

The conditions and cause of resonance ought to be known to the pupil.

He ought also to know how sounds are produced by the vocal organs of man, and to see clearly the similarity between such sounds and

those of the syren. As a case of the same kind, the construction and explanation of the Eolian harp ought also to be known to the pupil.

He ought to be well acquainted with the principles of interference as applied to sound.

He ought to be acquainted with the principles of harmony, to know the ratios of the vibrations corresponding to the notes of the gamut, to be able to give a clear account of the bearing of interference upon the question of consonance or dissonance, and to explain why those ratios which are represented by small whole numbers correspond to the most perfect harmony.

Light.

The candidate in the second course must be intimately acquainted with all the subjects mentioned in the first.

He must be able to apply his knowledge of total reflection to the explanation of the mirage of the desert.

He must be able to describe experiments by which white light may be produced by the admixture of its constituents.

He must know what is meant by *achromatism.*

He must be able to give a clear description of the undulatory theory, and to state how the colours of the spectrum are accounted for by that theory.

He must be able to define a ray of light in accordance with the undulatory theory.

He must be able to show how the reflection and refraction of light occur according to the undulatory theory.

He must be able to describe the appearances presented when incandescent metallic vapours are analysed by the prism. Especially must he be able to state what occurs when a sodium flame is thus analysed.

He must also be able to state what occurs when white light is transmitted through a sodium flame, and he must be able to describe an experiment which shall render manifest what occurs.

He must be able to state generally the relation that subsists between radiation and absorption by gases and vapours.

The lines of Fraunhofer must be known to the pupil, and from this knowledge in conjunction with the knowledge demanded by the foregoing paragraphs, he must be able to infer the probable constitution of the sun.

The pupil ought also to know the principles of interference as applied to light.

He ought to be able, in accordance with these principles, to account for the colours of thin plates and of striated surfaces.

The general principles of diffraction ought to be known to the pupil.

He ought to know what is meant by plane polarised light; to describe the act of polarisation in the language of the undulatory theory.

He ought to know what occurs when a beam of light is transmitted through a crystal of Iceland spar; and to describe the state of the emergent light as regards polarisation.

He ought to be able to describe the effects observed when light is transmitted through two plates of tourmaline cut parallel to the axis of the crystal.

He ought to be able to describe some form of the polariscope, and to state and explain by the principles of interference what occurs when a thin plate of selenite is placed between the polariser and analyser.

Heat.

The candidate in the second course must be intimately acquainted with all the subjects introduced into the first.

He ought to be able to give a clear statement of the *mechanical theory* of heat as distinguished from the *material theory*.

He must know what is meant by the "mechanical equivalent of heat," and how it has been determined.

He must know what is meant by specific heat at constant volume and at constant pressure, and to have in his memory the numerical ratio of the two specific heats.

He ought to be able not only to explain the meaning of the difference between the two specific heats in accordance with the mechanical theory, but also to show how from this ratio the mechanical equivalent of heat may be determined.

Given the weight and velocity of a moving body he ought to be able to calculate the amount of heat generated by the stoppage of the motion.

He ought to be able to apply the conceptions of the mechanical theory to the phenomena of combustion.

He ought also to be able to show the bearing of the theory upon the phenomena of specific and latent heat.

Examination for Honours.

The candidate for honours must be intimately acquainted with the foregoing two courses. He must also show himself practically acquainted with the apparatus employed in acoustics, light, and heat.

The following are recommended as text books:—

The Elements of Natural Philosophy, by C. Brooke and Golding Bird, 12mo., 12*s.* 6*d.* (London, Churchill, 6th ed., 1867.)

Ganot's experimental and Applied Physics, translated by E. Atkinson, 8vo., 15*s.* (London, Longman, 2nd ed., 1867.)

Handbook of Natural Philosophy, by D. Lardner. 4 vols., 12mo., 20*s.* (London, Walton, 1856.)

Elementary Treatise on Heat, by Balfour Stewart, 12mo., 7*s.* 6*d.* (London, Macmillan, 1866.)

Heat a Mode of Motion, by J. Tyndall, 8vo., 10*s.* 6*d.* (London, Longman, 3rd ed., 1868.)

A Course of Eight Lectures on Sound, by J. Tyndall, 8vo., 9*s.* (London, Longman, 1867.)

SUBJECT IX.—MAGNETISM AND ELECTRICITY.

First Stage or Elementary Course.

Magnetism.

It is exceedingly desirable that the pupil's ideas of the fundamental facts and principles of magnetism should be as clear as our knowledge and his capacity can make them.

He ought to be made acquainted with the action of the natural magnet or loadstone on small pieces of iron. This is to be mentioned to him as the first fact observed, but for the explanation of which other facts are necessary. The action of two natural magnets upon each other ought to be described, and through this action a clear notion of the doctrine of *magnetic polarity* ought to be conveyed to the pupil's mind.

The power of the natural magnet to confer its own magnetic properties

upon steel, and the action of the natural magnet on the steel which it has magnetised, ought to be explained.

The action of two pieces of magnetised steel upon each other ought to be made clear, and from this action the fundamental law that like poles repel each other, and that unlike poles attract each other, ought to be deduced.

The distribution of magnetism in a bar magnet ought to be made clear. The effect of breaking the magnet into two halves; the effect of again breaking these halves; and through facts of this nature, a clear idea is to be conveyed that each molecule of the magnet is itself a magnet; the action of the magnet as a whole being the sum of the actions of its molecules.

It is of exceeding importance that the pupil should be taught to connect the facts of magnetism by means of the provisional conception known as *the theory of magnetic fluids*. The teacher will assure himself that a correct image of this theory is in the pupil's mind. He will at the same time be careful to inform the pupil that the theory is an image merely, which enables him to connect and classify his facts, and that it is not a proved scientific truth.

The theory is to be applied in explaining the difference between iron and steel as regards their power of accepting and retaining magnetism. The term *coercive force* and all that relates to it will here come under review.

The theory is also to be applied in explaining the first observed facts of magnetism, including in them, and illustrating by them the general phenomena of magnetic induction, or magnetisation by influence. Every student ought to have a clear image of the state of a piece of iron acted on by a magnet, and he ought to be able to explain why the attraction of the iron is a consequence of that state. He ought clearly to see that repulsion as well as attraction is at work, the resultant attraction being the difference of both.

He ought to understand that when the attracting magnet is very distant, the difference between attraction and repulsion is so small as to be imperceptible; this knowledge will render it easy for him to comprehend why the magnetic poles of the earth which give *direction* to a magnetic needle are incompetent to produce a motion of translation.

The pupil ought to know the facts of terrestrial magnetism; why it is that we consider the earth a magnet. It will be possible to make him acquainted with all that is known regarding the position of the earth's magnetic equator and of the terrestrial magnetic poles.

The terms declination (variation), inclination (dip), and magnetic intensity, ought to be explained to him.

Frictional Electricity.

Here also care must be taken to imprint the fundamental facts and principles clearly and firmly upon the pupil's mind. It is easy in the case of frictional electricity to let the pupil actually see some of the facts; and it is exceedingly desirable that he should do so. The same remark applies to the elementary facts of magnetism.

As in the case of magnetism, the fact first observed, namely, the attraction of light bodies by rubbed amber, must be shown to need other facts for its explanation.

The mode of exciting bodies by friction is to be described; the action of rubbed and unrubbed vitreous bodies upon each other; the action of rubbed and unrubbed resinous bodies upon each other; and the action of vitreous bodies upon resinous bodies, and the reverse, are to be clearly described and illustrated. From these facts the law is to be deduced

that bodies similarly electrified repel, and dissimilarly electrified attract, each other. The pupil ought to know why the terms vitreous and resinous, as applied to electricity, have been abandoned.

Having been made acquainted with the elementary facts and principles, the pupil is to be rendered familiar with the provisional conception called the theory of electric fluids. As in the case of magnetism, he is to understand that this theory is an image merely, and not a truth.

He ought to be made acquainted, by experiments performed or described, with the qualities of insulation and conduction. He ought to know the reason of the old division of bodies into electrics and non-electrics, and also the unsound character of this classification.

Clear definitions ought to be given as to what is to be understood by positive and what by negative electricity. The pupil must be able to determine the quality of the electricity with which any body is charged.

He must be thoroughly versed in the phenomena of electric induction, and must be able to apply the theory of electric fluids in the explanation of these phenomena. In connexion with the subject of electricity this is the most important part of the teacher's duty, for upon a knowledge of the facts and principles of electric induction the comprehension of almost all that follows it depends.

The pupil ought to be able to construct, or describe the construction, of an electrophorus, and to explain its action by reference to the principles of electric induction.

He ought to be able to explain the condenser by reference to the same principles.

He ought to be able to explain the charging and discharging of the Leyden jar by reference to the same principles.

He ought to be able to describe the charging of the prime conductor of an electric machine by reference to the same principles.

The knowledge implied in the last three questions embraces that of the construction of the condenser, the Leyden jar, and the electric machine. The first form of the Leyden jar ought to be known to the pupil.

The distribution of electricity on the surfaces of conductors is to be made known, and from it the power of points to disperse electricity ought to be deduced. The pupil ought to realise that in virtue of its self-repelling character an electric fluid always moves to the external surfaces of bodies. The power of flames in dispersing electricity ought also to be made known to the pupil.

He will now be ready to understand the form and theory of lightning conductors.

The physiological, deflagrating, and mechanical effects of the electric discharge ought to be known to the pupil. He ought also to be able to apply his knowledge to the explanation of thunder and lightning, and of the return shock.

Voltaic Electricity.

The simplest combinations for the generation of a voltaic current ought to be made known to the pupil. The electric state of the free ends of the two metals immersed in the exciting liquid ought to be described; he ought to be taught to apply the theory of electric fluids to the conception of two currents flowing in opposite directions, and then the omission of one of these currents as a matter of convenience ought to be made known.

It is very important that the pupil should have a clear physical image of the fundamental phenomena before his mind. As in cases formerly referred to, the teacher will be careful to explain that this

idea of a fluid flowing in a current is an image merely, and not a proved truth.

Galvani's experiment with the legs of the frog which he suspended by a copper hook on an iron railing ought to be explained; and also the experiment of Sulzer, where the tongue is placed between two metals.

The bearing of the experiment illustrating "the return shock" on Galvani's first observation ought to be explained.

The idea of an electro-motive force separating the two electricities and driving them in opposite directions ought to be distinct in the pupil's mind.

He ought to be made acquainted with the magnetical effects of the circuit, with the action of a current upon iron filings, with its action upon a freely suspended magnetic needle. In this latter action he is to be particularly well versed, so as to be able immediately from the deflection of the needle to infer the direction of the current, and from the direction of the current the deflection of the needle.

He must know the action of a current upon a bar of iron placed within a coil round which a current circulates. He must understand the magnetic properties both of the coil and of the bar.

He ought to be made acquainted with the simplest form of the multiplying galvanometer.

He ought to understand the principles of the needle telegraph.

Some of the chemical effects of the current ought to be made known to the pupil. He ought, for example, to have a distinct notion of the composition of water, and an equally distinct notion of its decomposition by the electric current.

Second Stage or Advanced Course.

Magnetism.

The more advanced pupils that undertake the second course ought to be intimately acquainted with all the subjects introduced into the first. The following additional subjects are to be mastered.

The disposition of the so-called magnetic curves round a bar magnet, round two bar magnets with similar or unlike poles adjacent to each other, and round a horse-shoe magnet, must be clearly understood. The pupil must know how a short magnetic needle, or of a short bar of iron freely suspended acts in relation to those lines, and he must be able to show that the lines are deducible from the doctrine of magnetic polarity combined with elementary mechanical conceptions.

He must be able to figure mentally the magnetic curves of the earth, and to see their relation to the line of dip.

He must have perfectly clear notions as to what is meant by the strength of a magnet. He must be able to compare the strength of magnets together, by the method of oscillation, by the torsion balance, or by the deflection of a small magnetic needle.

A knowledge of the principles and use of the torsion balance is quite essential.

He must know what is meant by the law of inverse squares, and be able to show how it has been experimentally demonstrated.

The pupil must be acquainted with the effect of temperature and of percussion upon a magnet.

He must know the meaning of the terms horizontal intensity, vertical intensity, and total force. He ought also to know what is meant by the variation of all of those, that they are different at different parts of the earth's surface, at different hours of the day, at different seasons of the

year. To a knowledge of the diurnal and annual variations, he ought to add a knowledge of the secular variation.

Frictional Electricity.

The more advanced pupil must be intimately acquainted with all the subjects introduced into the first course.

He must understand the cascade arrangement of the Leyden battery, as contrasted with the ordinary arrangement.

He must understand the application of the torsion balance to the measurement of electric force.

He ought to be able to think out and describe various new and simple forms of the condenser and the Leyden jar.

He ought to be able to carry forward the idea of an electric fluid to the conception of a current of such fluid; he ought to be able to describe the chemical and magnetical effects of such a current. He ought to be able clearly to contrast those actions as manifested by frictional electricity with the same actions as manifested by voltaic electricity.

He ought to be able to describe the experimental arrangements necessary to the production of primary, secondary, tertiary, and currents of higher order by the discharge of the electric battery.

He must understand the law of inverse squares as applied to electricity, and clearly comprehend its limitations.

The diurnal variation of atmospheric electricity ought to be known to the pupil.

The application of the unit jar in the measurement of electric charges ought to be known to the pupil.

The terms quantity and intensity (or as it is called by some *density*) as applied to electricity ought to be clearly understood. The relation of the heating power of an electric discharge to its quantity and intensity ought also to be known to the pupil.

Voltaic Electricity.

The more advanced pupil must be intimately acquainted with the subjects mentioned in the first course.

To the electro-magnetical knowledge there demanded he is to add the knowledge of determining the strength of a current by the deflection of a magnetic needle.

He ought also to be able to determine the relative strength of two currents by their chemical action.

He ought to know how the magnetism of a bar of iron augments in intensity as the currents which surround it augments in strength.

He ought to know how the *attraction* of iron by an electro-magnet augments as the exciting current is augmented. In this case he ought to see and be able to describe the difference between a piece of soft iron and a piece of exceedingly hard magnetized steel.

He ought to be acquainted with induced currents, their various modes of generation, and their laws of action.

He ought to be able to explain the ordinary madical magneto-electric coil. He ought also to be able to describe Ruhmkorff's coil, and some of the effects obtainable by it.

He ought to be able to sketch a current reverser.

He ought to understand the principles of the astatic needle.

He ought to be able to describe the phenomena of the extra-current.

He ought to be made acquainted with the mutual action of currents upon each other, with the attractions and repulsions which are dependent upon direction.

He ought to know how a coil of copper wire may be suspended so that when a current flows through the wire it shall, like a magnetic needle, obey the directive action of the earth.

He ought to be acquainted with the principles of electro-plating, adding to a knowledge of the decomposition of water a knowledge of other decompositions, by which conducting surfaces may be coated with copper, silver, or gold.

He ought also to be made acquainted with the chemical actions that occur within a voltaic cell when the current circulates.

The arrangement of cells into batteries ought to be described. The pupil ought to be made acquainted with the *pile* of Volta and the *crown of cups*. He ought also to have explained to him the battery of Grove.

The reason for employing two fluids in the cells of this battery ought to be explained.

The dependence of the heat generated on the resistance overcome by the current ought to be made known. He ought to be taught to form as definite a conception as possible of resistance in relation to electro-motive force, and to understand the formula which expresses the relation of heat, resistance, and current strength.

He ought to understand the theory of molecular currents, and to be able to apply this theory in explanation of the phenomena of magnetism.

Examination for Honours.

Magnetism.

A candidate who enters the honours examination must be intimately acquainted with the foregoing two courses in magnetism. In addition to this he must be able to show that he has a competent practical knowledge of the apparatus employed. He must show ability in devising and executing experiments, and ought to be able in the presence of the examiner to perform experiments illustrative of any or all of the subjects introduced in the foregoing two courses.

Frictional Electricity.

The candidate ought also to know the facts and principles of dia-magnetism. He ought also to be able to describe and explain the deportment of crystalline bodies between the poles of a magnet.

In frictional electricity, besides an intimate acquaintance with both of the foregoing courses, the candidate must possess a competent practical knowledge of the apparatus employed. He must be able to devise and execute experiments in the examiner's presence. He must be intimately acquainted with the experiments with a rotating mirror by which Wheatstone determined the velocity of electricity and the duration of the electric spark.

Voltaic Electricity.

Besides being intimately acquainted with the two foregoing courses, the candidate must have a practical acquaintance with the apparatus employed in voltaic electricity.

He must be intimately acquainted with the laws of Ohm which express the relation of electro-motive force, internal and external resistance, and current strength.

He must be able to apply the principles of the dynamical theory of heat to the heat phenomena of the voltaic current. He must be clearly informed as to the manner in which the heat is distributed within and without the battery.

As a text book, in addition to the works on Physics and Natural Philosophy recommended in the Syllabus of Subject VIII., the following work on Electricity may be used:—

Electricity, by R. M. Ferguson, 12mo., 3*s*. 6*d*.
(Edinburgh, Chambers, 1866.)

SUBJECT X.—INORGANIC CHEMISTRY.

First Stage or Elementary Course.

Pupils presenting themselves for examination will be expected to possess a knowledge of the following subjects:—

Definition of chemistry. Simple and compound matter. Different modes of chemical action. Combining weights. Volume weights. Principles of chemical nomenclature. Symbolic notation. Graphic notation. Chemical formulæ. Chemical equations. Atomicity of elements. Simple and compound radicals. Definition of a compound radical. Classification of elements into metals and non-metals, into chlorous and basylous elements. Classification according to atomicity.

French and English systems of weights and measures. Conversion of English into French weights and measures. The crith and its uses.

Hydrogen.—Its preparation and properties.

Chlorine.—Preparation of chlorine from hydrochloric acid. Analysis and synthesis of hydrochloric acid. Properties and reactions of hydrochloric acid.

Oxygen.—Its preparation and properties. Allotropic oxygen or ozone. Formation and reactions of water. Preparation and properties of hydroxyl. Oxides and oxacids of chlorine.

Boron.—How it occurs in nature. Its allotropic modifications. Boric anhydride. Boric acids.

Carbon.—Its preparation and allotropic forms. Preparation and properties of carbonic oxide and carbonic anhydride.

Nitrogen.—Its preparation and properties. Oxides and oxacids of nitrogen. Compound of nitrogen with hydrogen. Ammonia. Ammonic salts.

Sulphur.—Its properties and allotropic modifications. Compounds of sulphur with basylous elements. Compounds of sulphur with oxygen and hydroxyl.

Second Stage or Advanced Course.

In addition to the above subjects, pupils presenting themselves for the advanced examination will be assumed to have received instruction in the following:—

Theory of atoms and molecules. Empirical, rational, and constitutional formulæ. Absolute, latent, and active atomicity. Atomic and molecular combination.

Expansion of gases by heat. Reduction of gaseous volumes to standard pressure and temperature.

Manufacture of hydrochloric, nitric and sulphuric acids. Composition and manufacture of bleaching powder. Theory of bleaching. Suitability of water for domestic purposes. Causes of permanent and temporary hardness in water.

Bromine.—Hydrobromic and bromic acid.

Iodine.—Hydriodic, iodic, and periodic acid.

Fluorine.—Hydrofluoric acid.

Silicon.—Silica. Silicic acid. Silicic hydride. Names and formulæ of some of the more important silicious minerals.

Phosphorus.— Phosphoretted hydrogen. Acids and anhydrides of phosphorus.

Arsenic.—Arsenious and arsenic acids. Arseniuretted hydrogen. Detection of arsenic.

Antimony and Bismuth.—Preparation and properties of their chief compounds.

The monad metals, especially potassium, sodium, and silver. Manufacture of soda-ash.

The dyad metals. Barium, strontium, calcium, magnesium, zinc, cadmium, mercury, and copper.

The chief properties of the following metals:—Gold, aluminium, platinum, lead, chromium, manganese, iron, cobalt, and nickel.

Composition, preparation and properties of the more important compounds of these metals.

Outline of qualitative analysis. Reactions of the principal mineral acids and bases. Course pursued in the application of these reactions to the analysis of a mixture of several acids and bases.

Examination for Honours.

In addition to the above, candidates are expected to possess a knowledge of the following subjects:—

Theory of normal, acid, and basic salts. Constitutional formulæ of the various acids of phosphorus. Monatomic and polyatomic molecules.

The phenomena of combustion.—Thermal units. Absolute thermal effect, or total amount of heat evolved by various kinds of fuel and other combustibles. Pyrometric thermal effect, or intensity of heat evolved by combustibles. Translation of absolute thermal effect into its mechanical equivalent. Theory of flame. Source of light in luminous flames. Spectrum analysis, its principles and applications. Relations of specific heat to atomic weight.

The law of the diffusion of gases. The laws of electrolysis. The processes used in the quantitative analysis of the more commonly occurring minerals.

For preparation for examination in the above syllabus, the following works are recommended as text books:—

Lecture Notes for Chemical Students, by E. Frankland, 8vo., 12*s.* (London, Van Voorst, 1866.)

First Principles of Modern Chemistry, by U. J. Kay-Shuttleworth, 8vo., 4*s.* 6*d.* (London, Churchill, 1868.)

Introduction to Modern Chemistry, by A. W. Hofmann, 8vo., 4*s.* 6*d.* (London, Walton, 1865.)

First Step in Chemistry, by R. Galloway, 12mo., 6*s.* 6*d.* (London, Churchill, 4th ed., 1868.)

Lessons in Elementary Chemistry, by H. E. Roscoe, 18mo., 4*s.* 6*d.* (London, Macmillan, new ed., 1867.)

For the advanced course the following may be used in addition to the above:—

Chemistry, Inorganic and Organic, by C. L. Bloxam, 8vo., 16*s.* (London, Churchill, 1867.)

Manual of Elementary Chemistry, by G. Fownes, 12mo., 12*s.* 6*d.* (London, Churchill, 9th ed., 1863).

Elements of Inorganic Chemistry, by W. A. Miller, 8vo., 21*s*.
(London, Longman, 3rd ed., 1864.)
Chemistry for Students, by A. W. Williamson, 12mo., 7*s*. 6*d*.
(London, Macmillan, 1865.)
Qualitative Analysis, by R. Galloway, 8vo., 6*s*. 6*d*.
(London, Churchill, 5th ed., 1869.)

Besides these works the following are recommended for reading for honours :—

Second Step in Chemistry, by R. Galloway, 12mo., 10*s*.
(London, Churchill, 1863.)
Chemical Physics, by W. A. Miller, 8vo., 15*s*.
(London, Longman, 4th ed., 1867.)
Dictionary of Chemistry, and the Allied Branches, by H. Watts, in four Vols., 8vo., 1st Vol., 31*s*. 6*d*., 2nd Vol., 26*s*., 3rd Vol., 31*s*. 6*d*., 4th Vol., 24*s*. (London, Longman, 1863–66.)
Elementary Treatise on Heat, by Balfour Stewart, 12mo., 7*s*. 6*d*.
(London, Macmillan, 1866.)
Heat considered as a Mode of Motion, by J. Tyndall, 8vo., 12*s*. 6*d*.
(London, Longman, 2nd ed., 1866.)

SUBJECT XI.—ORGANIC CHEMISTRY.

First Stage or Elementary Course.

Pupils presenting themselves for examination will be expected to possess a knowledge of the following subjects :—

Definition of organic bodies; their ultimate analysis. Calculation of empirical formulæ. Compound organic radicals. Notation of organic compounds. Graphic and symbolic formulæ.

Organic Radicals.—Basylous or positive radicals. Preparation and properties of the monad radicals of the methyl series. Monad radicals of the vinyl and phenyl series.

Dyad basylous radicals of the ethylene series. Preparation and properties of ethylene.

Chlorous or negative radicals. Cyanogen. Oxatyl. Oxalic acid, its preparation and properties.

Hydrides of the Organic Radicals.—Methylic hydride or marsh gas. Paraffin. Benzol. Cyanic hydride or hydrocyanic acid. Oxatylic hydride or formic acid.

The Alcohols.—Definition of an alcohol. Methylic alcohol. Ethylic or common alcohol. Phenylic alcohol or carbolic acid.

The Ethers.—Definition. Preparation and properties of ethylic ether.

The Haloid Ethers.—Their constitution. Preparation and properties of ethylic chloride and iodide.

The Aldehydes.—Their nature and properties. Acetic aldehyde. Benzoic aldehyde or oil of bitter almonds.

The Acids.—Definition of an organic acid. Acetic acid. Lactic acid, Benzoic acid.

Ethereal Salts.—Definition and constitution of the ethereal salts of the monobasic acids. Preparation and properties of acetic ether and butyric ether.

Second Stage or Advanced Course.

In addition to the above subjects, students presenting themselves for this examination will be assumed to be acquainted with the following:—

Determination of the rational formulæ of organic acids and bases. Graphic and symbolic types of organic compounds. Reduction and development of the formulæ of organic bodies. Classification of organic compounds.

Organic Radicals.—Dyad basylous radicals of the acetylene series. Single and double cyanides. Manufacture of prussian blue and of oxalic acid.

Hydrides of the Organic Radicals.—Ethylic and amylic hydrides. Hydrides of the radicals of the phenyl series. Manufacture of coal-gas.

The Alcohols.—Classification, preparation and properties of alcohols 1. Monacid alcohols; methyl series, vinyl series, allyl series, pheny series. 2. Diacid alcohols or glycols; ethylic glycol and its derivatives 3. Triacid alcohols; glycerin, its preparation and properties.

The Ethers.—1. Ethers of the monacid alcohols;—methylic ether, allylic ether, phenylic ether. 2. Ethers of the diacid alcohols;—ethylenic oxide. 3. Ethers of the triacid alcohols;—glycylic ether.

The Haloid Ethers.—Haloid ethers of the monad, dyad, and triad positive radicals. Methylic chloride. Manufacture of chloroform. Ethylenic bromide.

The Aldehydes.—Formation and re-actions of the aldehydes of the methyl, vinyl, and phenyl series of alcohols.

The Acids.—Law of basicity of organic acids.

Monobasic acids:—Acetic or fatty series. Acrylic or oleic series. Lactic series. Pyruvic series. Glyoxylic series. Benzoic or aromatic series.

Dibasic acids:—Succinic series. Fumaric or acryloid series. Malic or lactoid series. Tartaric or glyoxyloid series.

The Anhydrides.—Definition and constitution of the anhydrides. Formation and re-actions of the anhydrides of monohydric monobasic acids, dihydric monobasic acids, and of dihydric dibasic acids.

The Ketones.—Derivation and constitution of the ketones. Preparation and properties of acetone.

Ethereal Salts.—Ethereal salts of dibasic and tribasic acids, and of monacid, diacid, and triacid alcohols.

Organic Compounds containing Nitrogen, Phosphorus, Arsenic and Antimony.—The more important natural and artificial alkaloids. Extraction of quinine from cinchona bark.

Organometallic Bodies.—Definition. Their behaviour and formation. Preparation and properties of zincic ethide, mercuric ethide and stannic ethide.

Examination for Honours.

In addition to the above, the candidate should be well acquainted with the following subjects:—

Determination of the specific gravity of gases and vapours. The methods employed in the analysis of gaseous organic bodies. Synthesis of organic compounds. Determination of the constitutional formulæ of organic bodies. Isomerism, metamerism and polymerism in organic bodies.

Organic Radicals.—Normal, secondary, and tertiary monad radicals. Isomerism of ethylene and ethylidene compounds. Relations between methyl, oxatyl and cyanogen.

Hydrides of the Organic Radicals.—Relations of the basylous monad radicals to their hydrides.

The Alcohols.—Relations of the normal monacid alcohols to the monad C_nH_{2n+1} radicals, the dyad C_nH_{2n} radicals, and to the hydrides of the $C_n H_{2n+1}$ radicals.

Secondary monacid alcohols. Isopropylic, pseudamylic and pseudohexylic alcohols.

Tertiary monacid alcohols. Pseudobutylic alcohol.

Normal and secondary alcohols of the phenyl series.

Relations of glycerin to isopropylic and allylic alcohol; also to glyceric, tartronic, and acrylic acid.

Other polyacid alcohols :—Erythrite, mannite, glucose.

The Acids.—Difference between hydricity and basicity of acids.

Normal, secondary, and tertiary fatty acids. Relations of the fatty acids to the C_nH_{2n+1} series of radicals, and to the $C_nH_{2n+1}Ho$ series of alcohols. Relations of the fatty acids to each other; ascent of the series.

Normal, secondary, and olefine acids of the acrylic or oleic series. Relations of the acrylic to the acetic series of acids.

Definition and classification of the acids belonging to the lactic series Relations of the lactic to the fatty and acrylic series of acids. Isomerism in the lactic series.

Relations of the pyruvic series of acids to the oxalic and lactic series.

Relations of the glyoxylic series of acids to the glycerin series of alcohols.

Constitution and classification of the dibasic acids. Relations of the succinic series of acids to the lactic and acetic series, and to the glycols.

Isomerism in the fumaric series of dibasic acids.

Tartaric or glyoxyloid series of dibasic acids. Varieties of tartaric acid.

Constitution and classification of the tribasic acids.

The Ketones.—Isomerism in the ketone family.

Organic Compounds containing Nitrogen, Phosphorus, Arsenic, and Antimony.—The amines, phosphines, arsines, and stibines. Primary, secondary, and tertiary organic bases. Monamines, diamines, triamines, and tetramines.

Organometallic Bodies.—Their constitution and its bearing upon the doctrines of atomicity.

In addition to such of the works as treat on Organic Chemistry recommended in the Syllabus of Subject X., the student's attention is drawn to the following :—

Elements of Organic Chemistry, by W. A. Miller, 8vo., 24*s*.
(London, Longman, 3rd ed., 1866.)

SUBJECT XII.—GEOLOGY.

First Stage or Elementary Course.

A.—Preliminary Subjects.

a. Basis of Geology.—Definition of the objects of geology. Waste of land now going on by mechanical causes,—rain, running water, frost, snow, glaciers, and by the sea. Origin of rounded pebbles, grains of sand, and mud. Sediments carried in mechanical suspension in rivers. Deposition of strata now forming in the sea and in lakes from sediments

formed mechanically. Other strata formed in part or entirely of organic remains, and how they are preserved. Proof that stratified rocks generally were formed by deposition from water, as above, and that strata have been successively deposited and are of ages less or more apart. Definition of the term igneous as applied to rocks.

b. Common Geological terms.—Definition of "crust of the earth," clay, sand, gravel, shale, sandstone, conglomerate, breccia, limestone, lava, volcanic ashes, stratum or bed, *a formation*, group of formations. Recent, Cainozoic (tertiary), Mesozoic (secondary), and Palæozoic formations. Horizontal, inclined, vertical strata. Anticlinal and synclinal curves. Contorted strata, dip, strike, outcrop, a basin. Conformable and unconformable stratification, joint, slaty cleavage, fault, lode, vein. Names of some of the metamorphic rocks.

c. Composition of principal rocks and their common minerals.—Minerals that form granites and granitic rocks; Syenites, Diorites (greenstones), Basalts, Dolerite, gneissic rocks, limestones. Coal, what originally formed from. Colouring matter of rocks.

d. Disintegration and Solutions.—Disintegration, and solutions of minerals composing rocks by means of acids; mineral springs, and substances in chemical solution in rivers, lakes, and the sea. How produced.

e. Snow and Ice.—How glaciers are formed from snow. Movement of glaciers and transport of matter on their surfaces. Moraines. Erosion of rocks, over which glaciers flow. Icebergs, whence derived. Transport of matter from cold to warmer latitudes by icebergs.

f. Rivers.—Cutting out of terraces *and valleys* by rivers. Transport of material seaward, and gradual growth of Deltas.

g. Marine Denudation, Transport and Consolidation of Material and Fossilization.—Waste of sea coasts by breakers and by help of landslips. Rounding of pebbles and grains of sand on shores and in streams. The effect of long continued marine denudation on the land; formation of bays and head-lands, &c. Distribution of sediments derived from land over sea bottoms, forming modern marine strata. Consolidation of strata by pressure, chemical changes and heat. Preservation of shells, &c., in seas, lakes, and delta deposits, in alluvium, and in and under peat, blown sand, and volcanic ashes.

h. Central Heat, Volcanos, Earthquakes, and other Movements of the Earth's Crust.—The connexion of the corals reefs of the Pacific Ocean with the gradual sinking of the sea bottom. Fringing reefs, barrier reefs, atolls. Volcanos and their connexion with some areas of upheaval of land above the sea. Raised beaches and sea bottoms. The structure of volcanos. The wave-like motion of earthquakes. General structure of mountain chains. The existence of so-called central heat in the earth. Change of common strata, such as shale and slate, sandstone, limestone, &c., into mica-schist, gneiss, quartz rock, crystalline limestone, &c. (metamorphism).

B.—Classification of Animal and Vegetable Life.

i. A rudimentary acquaintance with the meaning of the names of those CLASSES of animals and plants that are or may be found fossil, such as Mammalia, Aves (birds), Reptilia, Pisces (fish), Insecta, Myriapoda (centipeds, &c.), Arachnida (spiders, &c.), Crustacea (crabs, &c.), Annelida (worms, &c.), Echinodermata (sea-urchins, starfish, &c.), Cephalopoda (cuttle-fishes, &c.), Pteropoda, Pulmonata (land snails, &c.), Gasteropoda (periwinkles, limpets, &c.), Conchifera (oysters, cockles, &c.), Brachiopoda (terebratula, &c.), corals, sponges. The Vegetable Kingdom: the names of the classes and orders of plants.

Succession of Strata, Igneous Rocks, &c.

C.—Palæozoic Series.

k. Oldest known stata or the Laurentian rocks. Their metamorphic character. Oldest known fossil. Huronian rocks of Canada.

l. Cambrian and Silurian strata.—Cambrian rocks, and their traces of fossils. Lingula flags and Tremadoc slates. Llandeilo and Bala beds, and the lavas and volcanic ashes associated with them. Llandovery or Pentamerus beds. Upper Silurian series. Leading kinds of fossils common in these formations, such as the genera of Graptolites, Corals, Brachiopoda, Conchifera, Cephalopoda (chambered shells), Echinodermata, Crustacea (especially the Trilobites), and first appearance of fish remains and land plants.

m. Old Red Sandstone and Devonian strata.—The areas in Britain that formed land before the deposition of the Old Red Sandstone. Unconformities of Old Red Sandstone on older rocks. Division into lower and upper Old Red Sandstone and unconformity. The nature of the rocks. The fish found in the lower, and the fish, fresh-water shells and plants in the upper Old Red Sandstone. *Devonian strata.*—Commonly divided into lower, middle, and upper. Their marine fauna, corals, shells bivalve and univalve, Goniatites and other cephalopoda, Trilobites, &c. Difference between the Silurian and Devonian genera and species.

n. Carboniferous strata.—The ordinary succession of these strata in Wales and the South of England (See also parts of 16 in Advanced Stage). The kinds of corals, shells, and fish found in the Carboniferous Limestone, and other beds. The kind of sections found in the *Coal-measures*. The Underclay generally below beds of coal. How coal was formed from fossilized plants. How there came to be many beds of coal in one coal-field with beds of shale, ironstone, and sandstone between.

o. Permian formations.—Their succession in England and Germany, and the proofs of their unconformity on the Carboniferous strata. The structure of the Rothliegende or Brecciated Conglomerates, the Marl-slate or Kupferschiefer, the Magnesian limestone (Zechstein). Their fossils.

D.—Mesozoic or Secondary Series.

Lower Mesozoic.

p. New Red Sandstone or Trias.—British divisions: 1st. New Red Sandstone (Bunter); 2nd. New Red Marls (Keuper). Continental divisions. New Red Sandstone, Muschelkalk, New Red Marle. Unconformity on Permian and older rocks. Great changes of life in passing from Palæozoic to Mesozoic times. Change in the relative numbers of Brachiopoda and Conchifera when compared with Palæozoic rocks, and continuation of this down to present day. New Cephalopoda, encrinites, fish, and reptiles. First known mammal. Plants of the Keuper sandstone, crustacea, reptiles, &c. Origin of rock-salt by evaporation Gypsum of red marle. Parts of what is now the British Islands that formed land before the deposition of the Trias.

q. Rhætic or Penarth beds.—(See 19, p. 92.)

r. Lias formations and Oolites.—(Jurassic of the continent). Division into Lower, Middle, and Upper Lias, and Lower, Middle, and Upper Oolites. The names of the formations included in each of these. Characters of the rocks. Great development of life of these periods. Leading marine fossils of the Lias and land plants and insects. Common

genera of Brachiopoda and Conchifera, Gasteropoda, Cephalopoda, Echinodermata, Fish, and Reptiles. Leading fossils of the Oolites as above, and also Mammalia. Proofs of land in the neighbourhood of the British Liassic, and Oolitic seas.

s. Purbeck and Wealden strata.—Their estuarine character, and proofs of this from the fossils. Generic names of leading fossils. Proofs of the existence of a neighbouring large continent.

Upper Mesozoic.

t. Cretaceous series.—British divisions, Lower and Upper and their subdivisions. The nature of the strata and general grouping of fossils (as in *r* above). Differences when compared with Oolitic genera and species. Uppermost Cretaceous beds absent in Britain, viz. the Maestricht and Faxoe beds and the beds of Aix-la-Chapelle. Account of these.

E.—Cainozoic or Tertiary Series.

u. Eocene or Lower Tertiary.—Meaning of the terms Eocene, Miocene, and Pliocene. Areas occupied by the English and French Eocene strata, and divisions of the English Eocene strata. Their fossils, freshwater, estuarine, and marine. Proofs of neighbouring land in freshwater shells, plants, and terrestrial mammalia.

v. Miocene or Middle Tertiary, of Bovey-Tracey, Mull, &c. French marine strata and freshwater and volcanic formations. The kinds of fossils they contain. The Swiss, Italian, and other continental beds. The floras of the period, insects, mammalia, reptiles, shells, &c. The Arctic Miocene beds, and flora. Indian Miocene strata and their fossils.

w. Post-Pliocene strata, Crag, &c.—Divisions of the British Crag, characters, and fossils, marine and terrestrial. Economic products. Crag of Belgium. Proportions of recent species in the different members of the Crag. Sub-Appenine strata and those of Sicily.

x. Glacial period and other strata later than the Crag.—The Forest beds beneath the boulder clay, and the union of Britain with the continent, and its Flora, terrestrial Fauna, and shells. (See also 26, p. 94.) The glaciers of the glacial period, before, during, and after the deposition of the marine boulder clays. The origin and nature of the boulder clay. Other proofs of a cold climate, and the marine and terrestrial Fauna of the period.

Second Stage or Advanced Course.

A.—Preliminary Subjects or Principles.

1. All contained in *a* of the elementary stage.

2. All contained in *b*.

3. All contained in *c*, and the chemical constituents of silica, various felspars, micas, augite, diallage, hornblende, garnet, obsidian, pitchstone, pumice. Limestone, Magnesian limestones or Dolomite. Coals, such as common house and furnace coals, cannel coals, and anthracites. Iron ores. The colouring matter of rocks. The general relative proportions in the known crust of the earth of mineral substances, such as silica, alumina, lime, magnesia, iron, &c. &c.

4. *Chemical disintegration.*—Chemical disintegration of rocks on a large scale; formation of kaolin, fireclays and other clays and shales. Origin of mineral springs, and substances in solution in rivers, seas, and other waters. Skeletons of shell fish and other marine and fresh water animals, whence derived, and how strata are formed of these.

5. *Effects of snow and ice.* — What is a glacier, and how formed. Change of snow into solid ice. Stratification and veined structure of ice. Inclinations of beds and surfaces of glaciers. Why glaciers flow. Rates of progress. Crevasses. Moraines, lateral, medial, terminal, and how they are formed. Erosion of rocks under glaciers and its results. Flow of water from lower ends of glaciers. Destruction of terminal moraines, and circumstances that induce their occasional preservation. Oscillation of size of glaciers. Deepening of valleys. Signs left by glaciers that have disappeared. Icebergs of Arctic and Antarctic regions and of South America; how formed. Ocean currents. Transport of matter by icebergs, and its distribution over existing sea bottoms. Transport of detritus by coast ice and river ice.

6. *Landslips.*—Landslips in mountainous and hilly regions, and landslips on sea coasts. Their effect in bringing matter within the influence of running water and of the sea.

7. *Rivers.* — Erosive and transporting power of brooks and rivers. Their influence in forming gorges and valleys. Origin of waterfalls. Amount of matter carried seaward by great rivers such as the Nile, the Ganges, the Mississippi, &c. The mode of formation and gradual growth of deltas and their possible age. Filling up of lakes by sediments. General effects on the form of the ground and lowering of level of continental and smaller areas by combined effects of chemical disintegration, rain, rivers, frost, snow, and glacier ice.

8. *Marine denudation.*—Waste of sea coasts by breakers and landslips. Formation of pebbles and sand on sea coasts. Amount and nature of waste of boulder clays of eastern coasts of England, &c.; of Tertiary strata, and of Cretaceous and Oolitic strata on east and south coasts. Waste of harder rocks of west of England, Wales, and Scotland. Power of breakers in moving sand and shingle, and large blocks of stone. Effect of prevalent winds on waste and transport of material along shores. Silting up of estuaries. Effect of groins and other artificial obstructions on coasts. Warping of alluvial tidal flats. Forms of sea cliffs and origin of many bays and headlands. Origin of great plains of marine denudation by combined action of breakers, landslips, and general lowering by waste of the interior of countries. Subsequent upheaval of such plains and renewed scooping out of valleys. Origin of certain tablelands and their valleys.

9. *Distribution of Material in Sea, &c. forming Modern Strata.*— Transport of matter by great marine currents, passing mouths of rivers and along coasts. Transporting powers of tidal currents. Sifting action of the sea in arranging sediments along its bottom. Icebergs (see 5). Modern formation by above causes of beds of clay, sand, gravel, and boulder beds, and mixtures of these. Volcanic ashes falling in sea and lakes. General formation of lacustrine strata. Formation of beds of limestone by organic bodies in seas, lakes, and lagoons. Coral reefs (see 10). Salts carried in solution in rivers into lakes, evaporation of surplus water, concentration and precipitation. Origin of rock salt, &c.

10. *Fossilization and Consolidation of Strata.*—Shells and other marine organic remains buried in sediments. Also terrestrial plants. Worm burrows. Terrestrial animals. Organic remains in lakes and river deltas, in alluvial beds and brickearths; in and under peat, under blown sand, and in volcanic ashes and under lavas. Formation of sediments by foraminiferæ, &c. in deep seas. Consolidation of strata by pressure, infiltrations, and precipitations, chemical decomposition and recomposition and heat.

11. *Central Heat, Volcanos, Earthquakes, and other Movements of the Earth's Crust.*—Theory of Coral Reefs. Fringing reefs, Barrier reefs, Atolls, and proofs of gradual subsidence of the sea bottom. Connexion

of coral reefs with the volcanic islands of the Pacific Ocean and areas of partial upheaval. Upheaval of the west coast of South America. Oscillations of level on the coast of the Baltic, Greenland, &c. Raised beaches and sea bottoms.

Theories of central heat how inferred. Radiation of heat from the earth, consolidation and theory of the formation and shrinkage of its crust. External phenomena of volcanos, and theories of volcanic action. Earthquakes. Mallet's theory, and oscillations of level accompanying earthquakes.

Metamorphism of rocks. Theory of slaty cleavage, passage of shales clayslate, sandstone, limestone, and their intermediate gradations into mica-schist, chlorite-schist, various kinds of gneissic rocks, quartz-rock, crystalline limestones, &c. Special development of distinct minerals in rocky masses. Relation of the above to gradual subsidence of rock masses and accumulation of strata above them. Origin of mountain chains. Disturbance and contortion of strata in successive stages, and probable causes of these phenomena.

B.—Classification of Animal and Vegetable Life.

12. All contained in *i* of the Elementary stage, p. 90, together with a general knowledge of the orders of Mammalia, Birds, Reptiles, Amphibia, Fish, Insects, &c., Crustacea, Echinodermata, Cephalopoda, Pteropoda, Pulmonata, Gasteropoda, Conchifera, Brachiopoda, Polyzoa, Corals, &c., and the classes and orders of the vegetable kingdom.

Succession of Strata, Igneous Rocks, &c.

C.—Palæozoic Series.

13. *Laurentian rocks* of Scotland, and Lower and Upper Laurentian rocks of Canada, &c. Huronian rocks of Canada. Their metamorphic character and peculiarities of structure. Eozoon Canadense, its nature, structure, and mode of growth. Ages of their metamorphism, and the inferences to be drawn from this.

14. *Cambrian and Silurian strata. Cambrian rocks* and their passage into the Lingula flag series. Fossils of the Cambrian rocks; their slaty cleavage and slate quarries.

Lower Silurian.—Lingula flags, their lithological character and fossils. *Tremadoc slates*, their lithological character and fossils. Unconformity of the Llandeilo and Bala beds on these, and break in the succession of life. *Llandeilo and Bala beds*, their lithological character and fossils. The igneous rocks, lavas, ashes, &c. associated with these.

Upper Silurian.—Llandovery or *Pentamerus beds*, their fossils and unconformity on the Lower Silurian strata, and partial change of species. Remainder of the *Upper Silurian strata* of the Wenlock and Ludlow series, their characters and fossils. First appearance of fish. Remains of plants. Reasonings on the connexion of unconformable stratification with partial or total breaks in the succession of species and genera in time. (This may be applied to all the cases of unconformity subsequently noticed.)

15. *Old Red Sandstone and Devonian strata.*—Passage of Upper Silurian into Lower Old Red Sandstone in Wales and on its borders. Disappearance of the life of the Silurian period. The land that existed in Scandinavia and Britain before the deposition of the Old Red Sandstone, and round and on which the Old Red beds were deposited. Fish of the lower Old Red Sandstone; their distinctive characters.

Upper Old Red Sandstone.—Lithological characters, fish, shells, and plants. Unconformity of the upper on the lower Old Red Sandstone, and approximate or actual passage of the former into the Lower Carboniferous strata. Condition of the waters in which the Old Red Sandstone formations were probably deposited. If partly glacial, and the signs of this?

Devonian strata.—The division of these strata commonly made into Lower, Middle, and Upper Devonian. The marked difference of conditions of deposit shown in the general nature of their fossils, viz., the fish of the Old Red Sandstone, and the Corals, marine bivalve and univalve shells, Cephalopoda and Trilobites of the Devonian strata. The stratigraphical relation of the Devonian strata to the Silurian rocks of Devon and Cornwall, of Germany, and North America. The relation of the so-called Upper Devonian beds to the Carboniferous strata. The appearance of new genera and species in the Devonian rocks. The plants of the North American beds.

16. *Carboniferous strata.*—Succession of Carboniferous strata in Wales, and its borders, and the south of England, viz., Lower limestone shale, Carboniferous limestone, Upper limestone shale, Millstone grit, and Coal-measures. The lithological characters of these and their fossils, marine, freshwater, and terrestrial. The manner in which the beds below the Coal-measures were accumulated. The manner of the formation of the Coal-measures, the peculiar strata beneath each (or most) beds of coal, the nature of the plants that formed the coal, their mode of growth, and the cause of the succession of beds of coal in thick series of strata. The gradual passage of the Carboniferous strata into a set of beds differently arranged in their stratification, especially in their lower members, proceeding northwards through Lancashire and Yorkshire into Northumberland, and Scotland. The physical causes that produced this difference. Also the absence of certain members of the series in some of the English, and in part of the Scotch coal fields, and the physical phenomena that caused this absence. The Carboniferous series as developed in Ireland. The Carboniferous rocks of the continents of Europe and North America. Their resemblances to those of the British islands; climate, its average uniformity in space and time during this epoch. The surface areas occupied by the European Carboniferous strata now. The areas where they may be concealed under newer formations. The areas where originally formed, viz., which they spread over before reduced to their present limits by denudation. The disturbances of the Carboniferous rocks, and the reasons why coal fields (like parts of many other formations) so often lie in basins. Various kinds of coal, such as the varieties of coal commonly called bituminous, cannel coal, and anthracite. The chemical changes that vegetation underwent in its passage into coal, first on the surface, and afterwards under pressure. The passage of "bituminous" into anthracite coal and the probable reason, and the connexion of this subject with highly disturbed areas. Specialities. Development of crustacea of the Carboniferous rocks as distinguished from those of the Devonian and Silurian periods. Prevalence of certain genera of brachiopoda and conchifera, and relative proportions of these in the Carboniferous rocks when compared with older formations. Fish and reptiles of the Carboniferous rocks. Footprints, rain drops, land shells, and insects, and what they indicate. Ironstones. Mineral veins in Carboniferous limestone series.

17. *Permian formations.*—Succession of these in Britain, Germany, and Russia. 1st. The Rothliegende, its structure, and the evidences of the glacial agencies by which parts of it were deposited. 2nd. The

Kuperschiefer of Germany and Marle-slate of England, with mineral contents, fish, &c. 3rd. The Magnesian limestone (Zechstein), its mineral character and composition; its fossils; evidence of their palæozoic character, partial community of species, and numbers and size when compared with the genera and species of the Carboniferous limestone. Cause of this. Unconformity on the Carboniferous and older rocks; submersion of old lands during its deposition; bearing of this on conglomeratic and brecciated structure of the Rothliegende and the general development of the life of the period, including plants and reptiles.

D.—Mesozoic or Secondary Series.

Lower Mesozoic.

18. *Divisions of Trias, or New Red Sandstone series* (see *p*, p. 91).—Unconformity and great break in succession of life in passing from Permian to New Red Sandstone. Great development of conchifera and decrease of genera of brachiopoda. The relation of this to lapse of time, as shown by unconformity, and continued prevalence in later times of many of these early Mesozoic types. The generally unfossiliferous character of the New Red Sandstone beds (Bunter), and their minor divisions in England. The absence in England of the Muschelkalk, and its presence on the Continent. Its fossils (see *p*, p. 87). The minor divisions of the New Red Marle (Keuper). Its fossil plants and reptile bones and footprints. Microlestes. Rain drops. The rock salt of this formation, and how it was deposited. Theory of inland salt lakes or seas of the present day, and the bearing of this and of the above-named marks of rain drops and footprints on the point. New Red Sandstone of the United States, and numerous footprints of reptiles and impressions of bird-like feet. Gypsum. Those parts of the British islands that formed land before and during the New Red Sandstone period.

19. *Rhætic or Penarth Beds.*—Intermediate between New Red Marle and Lower Lias. Gradual passage of nearly unfossiliferous red marles into these more fossiliferous strata. Character and names of some of the common fossils, such as *Avicula contorta, Cardium Rhæticum*, &c. Their affinities with Liassic forms and conformable passage into that formation in Britain.

20. *Lias formations and Oolites.* (Jurassic of the Continent).—Names of the several formations of the Lias and Oolites between the Lower Lias and the Portland Oolite in serial order, and their grouping into Lower, Middle, and Upper Lias and Oolite. Lithological characters of the Liassic formations. Fossils of the different formations. Plants and insects. Corals, brachiopoda, conchifera, gasteropoda, cephalopoda, echinodermata, crustacea, fish, and reptiles. The distinctive characters of some of these, their relative numbers compared with the same classes in the Palæozoic rocks. Nature of the connexion of the Lias with the Inferior Oolite. Lithological characters of the Oolitic formations and their uses. Marine fossils of the different formations of the above-named classes; also mammalia. Evidences of the existence of older land in the neighbourhood of the Liassic and Oolitic seas, and of the climate of the period drawn from plants and animals. Names of the most characteristic genera of Lias and Oolites, especially with reference to their prevalence, such as the names of the prevalent genera of brachiopoda, conchifera, gasteropoda, and cephalopoda, echinodermata, crustacea, fish, and reptiles. Jurassic strata of the Continents of Europe and Asia. The Jura and the Alps, and the fossils of Solenhofen. Disturbance and metamorphism of Jurassic strata. Names of some of the species charac-

teristic of some of the formations, and extent of the community of species. Contrast the life of these epochs with similar developments in Palæozoic epochs.

21. *Purbeck and Wealden strata.*—Their general fresh-water nature and marine interstratifications. Extent of these formations in England and on the Continent. Their characters and thickness. Fossils of the Purbeck strata. Plants, land insects, mammalia, fish, reptiles, univalve and bivalve shells, and crustacea. Fossils of the Wealden formations as above. Evidences of the upheaval of extensive continental land of the period, and the manner in which the Purbeck and Wealden beds were deposited.

Upper Mesozoic.

22. *Cretaceous series.*—Description of the British divisions and subdivisions. Their lithological characters and passage of Weald clay into Lower Cretaceous beds in the Wealden area and Isle of Wight. Fossils of the formations noticed in the same way as those of the Oolitic strata. The Chalk, by what organic bodies chiefly formed. Comparison with similar deposits forming in existing oceans. Nature of flints interstratified with chalk, and vein and tabular flints. Resemblances and differences of the genera and species of the Oolitic and Cretaceous epochs, and the bearings these have on lapse of time between the deposition of the Portland Oolite and the commencement of the Atherfield clay. Continental Cretaceous geology generally. Hippurite limestone. Upper Cretaceous rocks unknown in Britain. Maestricht beds and Chalk of Faxoe in Zeeland, Denmark. Upper Cretaceous beds and flora of Aix-la-Chapelle. Cretaceous strata of North and South America.

II.—Cainozoic or Tertiary.

23. *Eocene or Lower Tertiary.*—Meaning of the terms Eocene, Miocene, and Pliocene as used by Sir Charles Lyell. Grouping of greater divisions and subdivisions of the English and French strata as usually given in manuals. Areas occupied by the English and French Eocene strata. Evidence of the upheaval of the Chalk and older strata of Western Europe before the Eocene period. Fossils of the Thanet sand and Woolwich and Reading beds, of the London clay, Bagshot, Bracklesham, and Barton beds, and of the Isle of Wight and Hampshire strata from the Headon to the Hempstead beds inclusive; viz., plants, foraminifera, brachiopoda, conchifera, and gasteropoda, marine, estuarine, and fresh-water; cephalopoda, echinodermata, cirripedia, crustacea, fish, reptiles, birds, and mammalia. The evidence shown by these of the manner in which the different formations or parts of formations were deposited; 1st, into three broad divisions, estuarine and fluvio-marine below; marine in the middle; and fresh water, estuarine and fluvio-marine above. Evidences of land and its nature drawn from plants and from mammalian remains. Plants of the various subdivisions, and association of plants in Hempstead series with Eocene shells of lower beds. The nummulitic beds of England, the Continent of Europe, Asia, and Africa. Evidences of climates of Eocene times as indicated by shells, reptiles, and plants, &c. Original extension and subsequent denudation of Eocene beds in Britain. Denudation of the Weald.

24. *Miocene or Middle Tertiary strata.*—British Miocene strata and igneous rocks. Fossils of and nature of the strata. French marine and fresh-water and igneous rocks. Their fossils and the mammalia of the period. Miocene beds of the Rhine, Switzerland, Bohemia, and other parts of the Continent of Europe. Their divisions, lithological

characters, and fossils. The Alps and other lands before the Miocene epoch, and the manner in which the Swiss, Italian, and other Miocene rocks were deposited. Theory of a glacial episode during Miocene times. Mammalia. The Miocene insects and flora, especially of the British, Swiss, Icelandic, and Arctic regions. Brown coal of England and the Continent. Disturbances of the Alps and Jura before and after the close of the Miocene epoch. Miocene rocks of India and the United States and their fossils.

25. *Post-Pliocene Strata, Crag, &c.*—(See *w*, p. 88) and in addition proofs of Britain having been joined to the Continent before the Crag epoch.

26. *Glacial period and other Strata later than the Crag.*—Old land surface of Britain later than the Crag and Forest beds. Their plants, mammalia, and shells. The Glacial period. Great glaciers before the deposition of the boulder drift in the northern and southern hemispheres generally, and in Switzerland and other mountain ranges specially. The signs of this. Boulder beds and arctic shells. Minor glaciers during and after the deposition of the boulder beds. Their signs. Erosion of valleys by ancient glaciers. Theory of the formation of rock-bound basins by glaciers and of other lakes by boulder beds and eskers or kaims. General nature of the fauna of the period. Union of the British islands and their union with the continent before and after the glacial epoch. Theories of the causes that produce this glacial period and of glacial periods in general. Volcanic rocks of the Eifel. Loess of the Rhine and other rivers, brick-earths, river-gravels, and alluvia of various ages. Mammalian and other bones in these in Europe, Asia, and America. Bone caves and the manner of the preservation of their fossils. Relics of man and his works in caves, river deposits, shell mounds of Denmark, &c., and in Swiss and other lakes. Contours of ground before and after the glacial period. Pre-glacial and post-glacial valleys.

27. Theories that have been proposed to explain the distribution of life in individual formations and throughout the whole geological series, or the origin, increase, distribution, and disappearance of species and genera commonly so called. The relations of the life of successive formations to each other generally. Relations of existing faunas and floras of the world to those of Miocene, Pliocence, and Post-pliocene age.

28. Water-bearing strata and underground drainage. Artesian and other wells. Rocks in which ores are found, and mode of occurrence of those in beds, lodes, and superficial detritus. The rules that ought to guide the miner in sinking for coal and other minerals, when the beds in which they lie are concealed by overlying and unconformable strata.

Examination for Honours.

In addition to the foregoing, candidates may be examined in any subjects treated of in standard manuals and other books mentioned below.

The following may be used as text-books :—

Principles of Geology, by Sir C. Lyell, 2 vols., 8vo., 32*s*.
(London, Murray, 10th ed., 1868.)

Elements of Geology, by Sir C. Lyell, 8vo., 18*s*.
(London, Murray, 6th ed., 1868.)

The Students Manual of Geology, by J. B. Jukes, 8vo., 12*s*. 6*d*.
(London, Longman, 2nd ed., 1862.)

The School Manual of Geology, by J. B. Jukes, 12mo., 4*s*.
(London, Longman, 1863.)
Introductory Text-book of Geology, by D. Page, 8vo., 2*s*.
(Edinburgh, Blackwood, 7th ed., 1867.)
Advanced Text-book of Geology, by D. Page, 8vo., 7*s*. 6*d*.
(Edinburgh, Blackwood, 4th ed., 1867.)
Physical Geography and Geology of Great Britain, by A. C. Ramsay, 8vo., 5*s*. (London, stamped, 2nd ed., 1864.)
Popular Physical Geology, by J. B. Jukes, 16mo., 5*s*.
(London, Routledge, 1866.)
Text-book of Geology, by J. D. Dana, 12mo., 7*s*. 6*d*.
(Philadelphia, 1864.)
Manual of Geology, by J. D. Dana, 8vo., 21*s*. (Philadelphia, 1863.)
A Handbook of Geological Terms, by D. Page, 8vo., 7*s*. 6*d*.
(Edinburgh, Blackwood, 2nd ed., 1865.)
Recent and Fossil Shells, by S. P. Woodward (Weale's series), 18mo., 5*s*. 6*d*. (London, Weale, 1851.)
Glossary of Mineralogy, by H. Bristow, 8vo., 6*s*.
(London, Longman, 1867.)

Other books that may be consulted:—

Siluria, by Sir R. I. Murchison, 8vo., 30*s*.
(London, Murray, 4th ed., 1867.)
Geological Observer, by Sir H. De la Beche, 8vo., 18*s*.
(London, Longman, 1853.)
Voyage of a Naturalist round the World, by C. Darwin, 8vo., 8*s*. 6*d*.
(London, Murray, 1845.)
The Origin of Species, by C. Darwin, 8vo., 15*s*.
(London, Murray, new ed., 1866.)
Catalogue of British Fossils, by J. Morris, 8vo., 10*s*.
(London, Van Voorst, 1843.)
Chart of the Characteristic British Tertiary Fossils, by J. W. Lowry, mounted on linen, 10*s*. (London, Stanford.)
Chart of the Genera of Fossil Crustacea, by J. W. Salter and H. Woodward, mounted, 10*s*. 6*d*. (London, Stanford.)

SUBJECT XIII.—MINERALOGY.

First Stage or Elementary Course.

A. Instruction in this subject should commence with a distinct understanding of the characters and circumstances by which minerals, properly so called, are to be distinguished from other inorganic substances, and of the position of this science in relation to the collateral sciences of physics, chemistry, and geology. Definitions of a mineral, a crystal, and of the conditions termed crystalline and amorphous. Occurrence of other more or less regular forms not crystals. Distinction of compound masses or mixtures of minerals.

B. *Crystallography*, as the essential means of appreciating the forms naturally assumed, under favourable conditions, by almost all inorganic bodies of definite composition, must commence with the needful definitions; faces, edges, and solid angles; plane figures of three, four, five, six, and eight sides; the names and chief features of the more important geometrical solid figures which occur among crystals; the object of

referring the faces to systems of axes, and the various directions in which these may be placed.

Method of drawing crystals isometrically.

Relation of the hemihedral to holohedral forms.

The grounds for grouping the various crystal forms into six systems.

Laws by which the derivation of one form from another within the limits of the same system is determined.

Complex or modified crystals may be regarded as combinations of the faces of two or more simple forms.

The leading figures of the six systems to be studied, with frequent practice in drawing.

Twin crystals and hemitropes; the relative position of the axes of their several portions.

Irregularities to which the surface of crystal faces is subject, certain angular elements remaining constant; measurement of these latter by instruments. Principles of the contact goniometer and of Wollaston's goniometer.

C. *Aggregation*, or natural grouping of—1stly, the distinctly crystallized minerals; 2ndly, of the crystalline minerals, especially with reference to structure and general form of masses of the useful minerals and of crystalline rocks.

D. *Other physical properties.*—The cleavage of crystallised substances, and its relation to crystalline form. Fracture, its various characters. Comparative hardness, how best determined. Different qualities of tenacity. Specific gravity of solids, how determined; the balance, the aræometer.

Property of magnetism; what substances are capable of being attracted by a magnet, and what is the comparative intensity of the effect. Polarity. Influence of certain minerals disseminated in rocks on the correctness of surveys.

Peculiarities of smell and of taste which distinguish a limited number of minerals.

E. *Optical characters.*—Single and double refraction, and their relation to certain crystallographical systems.

Different degrees of lustre and transparency.

Colour essential in some species, not so in others; varieties of colour, how far they are capable of definition.

Phosphorescence as produced by different methods and exhibited by certain minerals.

F. *Chemical characters.*—Simple or elementary substances; some of them occur as minerals; their symbols and the derivation of the same. Equivalents; chemical combinations; principal groups of these occurring in the mineral kingdom.

Dimorphism of particular substances, accompanied by a difference in other physical characters besides form.

The employment of acids in the discrimination of minerals.

The blowpipe, its form and uses; the reducing and the oxidizing flames. Trial of comparative fusibility, of the colour given to the flame, the incrustation on charcoal; the effects of fusing various metallic oxides with beads of borax glass.

Pseudomorphism.—The phenomena presented by minerals which have the composition of one mineral coupled with the form of another. Analogous action of fossilization or petrifaction.

G. General requirements of a system of classification of minerals.

H. The physiography or systematic description of minerals. This ast division should include all the more remarkable varieties as well as

species, and should take especial note of the modes and places of occurrence, as well as of the association of particular groups of minerals in certain veins or formations.

It would not be expected that the elementary course should include the description of the rarer substances, or of those species whose characters are not yet well ascertained, but attention should chiefly be given to those species which form the constituents of rocks and those which as ores supply the materials for the production of the usefu metals.

Second Stage or Advanced Course.

A. Discussion of the relation of true minerals to other inorganic substances, and how far bodies of organic origin may be classed among minerals.

B. The dependence of symmetry in crystal forms on the axial system. The crystallographical value of a face is the same as that of any plane parallel to it, on the same side of the centre of the crystal. Position of the normals to a face. The methods of indicating the faces, and thence the entire forms of crystals by symbols. Drawing of a sphere of projection in which the poles of the crystal faces may be shown. Convenience of representing in a great circle the poles of a zone of faces. The magnitude of the angle between the normals being the supplement of the mutual inclination of the planes, the first kind of measurement (*i.e.* between the normals) is adopted by certain authors, and is easily reducible into the other kind. Statement of the angular and linear dimensions requiring to be determined for the description of the simple forms of all the systems after the cubical.

Twin crystals, the twin plane, and twin axes; examples of their position in important minerals of the several systems.

C. Reticulated, wiry, and capillary forms, explanations suggested for their formation. Other peculiarities in grouping.

D. The prevailing directions of cleavage in the several crystallographical systems.

Determination of the specific gravity of a substance contained in a mechanical mixture.

Electricity; by what means this property is exhibited in different minerals.

E. Refraction of light; different positions of the ordinary and extraordinary ray in doubly-refracting bodies. Optic axes of a crystal, their variation in different species of minerals.

Polarized light, its connexion with double refraction. Construction of the polariscope.

Dichroism and pleochroism, a remarkable property of some few minerals.

F. Character of the chemical composition of the more complex minerals.

The electro-negative element in chemical combinations has the preponderating effect in influencing the external character.

Isomorphism, as shown by Mitscherlich, to result from a group of—1st, isomorphous acids; 2nd, of isomorphous bases. Polymeric isomorphism of Scheerer; its meaning, and the arguments in its favour. Vicarious or irregular replacement among one another of isomorphous constituents.

Testing of minerals in the moist way simply practicable for qualitative purposes.

Treatment of various metallic ores before the blow-pipes.

Pseudomorphous substances as arranged in groups according to the nature and degree of change they have undergone.

Discussion of anogenic and katogenic pseudomorphs, or those which have been produced above by oxidizing, and below by reducing processes respectively.

Extension of pseudomorphous action on a large scale to "gossans" and to geological formations.

G. Methods of classification as proposed by the leading authors in mineralogy. Review of the difficulties caused in classification by the occurrence of the isomorphous substances.

Discussion of the means of defining a species among minerals.

H. Species and varieties of minerals as described in the best manuals. Their occurrence under various circumstances to be particularly studied. The changes in composition wrought by nature (pseudomorphous action), by which one species is converted into another, and the essential points of difference between species much alike in certain characters, will be held of much importance in dealing with the minerals of special value or interest. It is not expected that the memory should be charged with the details of substances of very rare occurrence, or of doubtful independence as species.

Examination for Honours.

The questions will as a general rule be such as are embraced in the above syllabus, but candidates will be required to prove a practical acquaintance with minerals and with crystal forms, and will need to have studied some of the more advanced works mentioned below.

As text-books may be recommended—

Elementary Course of Mineralogy and Geology, by D. T. Ansted, 8vo., 12*s*. (London, Van Voorst, 1856.)

Elements of Mineralogy, by Jas. Nicol, 12mo., 5*s*. (London, Longman, new ed., 1858.)

Manual of Mineralogy, by J. D. Dana, 8vo., 7*s*. 6*d*. (New York, new ed., 1860.)

Glossary of Mineralogy, by H. W. Bristow, 8vo., 6*s*. (London, Longman, 1867.)

For more advanced students—

Elementary Introduction to Mineralogy, by Brooke and Miller. 8vo. 18*s*. (London, Simpkin, 1852.)

Crystallography, by Rev. W. Mitchell, in Orr's "*Circle of the Sciences*." 8vo. 3*s*. (London, Griffin.)

System of Mineralogy, by J. D. Dana, 8vo., 36*s*. (New York, 5th ed., 1868.)

Elemente der Mineralogie, von C. F. Naumann, 8vo, 9*s*. (Leipzig, Engelmann, 7th ed., 1868.)

Paragenesis der Mineralien, von. A. Breithaupt, 8vo., 5*s*. 6*d*. (Freiberg, Engelhardt, 1849.)

Handbuch der Mineralogie, von W. Haidinger, 8vo., 10*s*. (Vienna, Braumüller, new ed., 1865.)

Manuel de Minéralogie, par Des Cloiseaux, Tome I., 8vo., 17*s*. (Paris, Dunod, 1862.)

Manual of the Mineralogy of Great Britain and Ireland, by Greg and Lettsom, 8vo., 15*s*. (London, Van Voorst, 1858.)

When it is intended to teach this subject with special reference to the practical working of minerals, the physiographical part will be occupied more particularly with certain of the useful species and their associated substances, and the following works may be consulted:—

The Metalliferous Deposits of Cornwall and Devon, by W. J. Henwood. 1843.

Bischof's Chemical and Physical Geology, translated by the Cavendish Society, 2 vols., 8vo., 21*s*. (London, 1854.)

SUBJECT XIV.—ANIMAL PHYSIOLOGY.

First Stage or Elementary Course.

Questions will be confined to the under-mentioned topics.

Anatomical Preliminaries.

The general build of the human body.

The meaning of the terms skull, vertebra, rib, sternum; scapula, clavicle, humerus, radius, ulna, carpus, metacarpus, phalanges (of the hand); pelvis, femur, tibia, fibula, tarsus, metatarsus, phalanges (of the foot); integument, mucous membrane, connective tissue, tendon, ligament, cartilage, muscle, nerve.

The position in the body and the general form and size of the following internal parts:—The brain and spinal cord; the pharynx, the gullet, stomach, and intestines; the salivary glands, the liver and pancreas; the posterior nares, the larynx, trachea, and lungs; the kidneys and bladder; the heart and the great vessels; the thoracic duct, and the chief lymphatic glands; the spleen; the diaphragm.

Chemical Preliminaries.

The composition of air, water, carbonic acid, and ammonia.

The chemical elements of which protein, fat, and sugar are composed.

The nature of the most important mineral compounds which are formed in the body.

The ultimate chemical products of the decay and putrefaction of the dead body.

General View of the Body in Action.

The evidence that the body constantly wastes during life; the nature of the waste products, and of the compensation for waste; the essential characters of food stuffs.

The part played by oxygen in the economy.

The number, position, and uses of the sensory organs.

The nature of cilia and the movements to which they give rise.

The physiological properties of muscular tissue. The modes in which muscles give rise to movements and sustain the body in the erect posture.

The physiological properties of nervous tissue. The general functions of the brain and of the spinal cord. Local and general death.

Special Physiology.

The circulatory Organs.—The arrangement of the chambers of the heart and of its valves. The general differences between arteries, veins,

and capillaries. The course of the circulation of the blood and the reasons why the blood moves only in one direction. The meaning of the beat of the heart, of the pulse in the arteries, and of the jet-like flow of blood from a cut artery. The evidence of the circulation obtainable in the living body.

The Blood.—The phenomena presented by blood drawn from the body. The general nature of the corpuscles of the blood. The general composition of the blood. The difference between blood and lymph.

Respiration and other processes which modify the condition of the Blood.—The obvious differences between arterial blood and venous blood. How venous can be converted into arterial blood out of the body. How and where venous is converted into arterial blood in the body.

How the air which leaves the lungs differs from that which enters them. The general nature of the respiratory movements. The course of the air, when breathing takes place through the nose. The conditions which give rise to asphyxia.

The essential composition of the urine. The general structure of the apparatus by which its separation from the blood is effected.

The essential composition of the sweat. The general structure and functions of the skin.

The manner in which the blood enters and leaves the liver. The products yielded by the liver to the blood directly, and through the medium of the alimentary canal. The chief characters of the bile. The use of the gall-bladder.

The source of the heat of the body. The manner in which the temperature of the body is distributed and regulated.

Alimentation.—The quantity of dry solid and gaseous aliments required daily by an adult man. The classification of food stuffs. The economy of a mixed diet. What becomes of proteid, fatty, amyloid, and mineral food stuffs respectively. The nature and functions of the salivary, gastric, and pancreatic secretions. The manner in which nutritive matters are absorbed, and innutritious matters excreted, from the alimentary canal.

Animal Mechanics.—The different kinds of levers and their exemplifications in the body. The nature of joints, with examples of ball and socket, hinge and pivot-joints. The conditions of the production of the voice. The difference between voice and speech.

The Senses and their Organs.—The general structure of the organ of touch. The means of measuring the acuteness of the sense of touch in different parts of the body.

The general structure of the organs of taste and of smell. The external auditory passage and the tympanic membrane. The tympanum and how it opens into the pharynx. The chain of ear bones and their connection on the one hand with the tympanic membrane, and on the other with the membrane of the fenestra ovalis. The form of the membranous labyrinth and of the cochlea. The nature of the endolymph and perilymph and of the otoconia. The relation of the auditory nerve to the labyrinth. The manner in which the impact of sound-waves on the tympanic membrane affects the auditory nerve.

The eyelids, and the manner in which they are moved. The lachrymal apparatus. The form of the eye ball; its general structure, and the functions of its component parts. The manner in which the movements of the eye-ball are effected. The blind spot. The duration of luminous impressions. Colour-blindness.

The Nervous System.—The difference between the cerebro-spinal and the sympathetic systems. The nature and functions of the roots of the

spinal nerves. The evidence that the spinal cord is capable of effecting reflex action. The nature and functions of vaso-motor nerves. The most important functional peculiarities of the medulla oblongata. The evidence that the higher faculties of the mind have their seat in the brain. The number, names, and functions of the cerebral nerves.

Second Stage or Advanced Course.

In addition to the preceding, a knowledge of the following subjects will be required :—

The Circulatory System.—The minute structure of the organs of circulation. The manner in which they are supplied with blood and with nervous energy. The pericardium.

The detailed analysis of the movements and sounds of the heart, and of the phenomena of the pulse. The causes of blushing and of pallor. The influence of the respiratory movements on the circulation. The effect of irritation of the pneumogastric nerve upon the heart's action.

The structure of the lymphatic vessels and glands, and the connexion of the lymphatic with the blood vascular system.

The Blood, the Lymph, and the Chyle.—The sizes and the structure of the corpuscles of these fluids. The phenomena which they exhibit. Their probable functions. The composition of the blood in detail. The nature of the process of coagulation.

The Respiratory System.—The structure of the thorax. The pleuræ. The structure of the respiratory organs and the distribution of the blood through them. The analysis of the respiratory movements in detail. The mechanism by which coughing, sneezing, sighing, and hiccoughing are effected. The physical and chemical processes involved in the conversion of inspired into expired air, and of venous into arterial blood. The quantity of waste products excreted and of oxygen taken in by the lungs in twenty-four hours. The rationale of ventilation.

The Urinary System.—The minute structure of the kidney, ureter, and bladder. The circulation in the kidney and the changes which the blood undergoes in passing through it. The quantity of waste products of all kinds excreted by the kidneys in twenty-four hours.

The Skin.—The minute structure of the skin, of the hairs, nails, and glands connected with it. The muscles of the hair-sacs. The quantity of waste products excreted by the skin in twenty-four hours.

The Liver.—The structure of the liver, and the course of the blood through it. The arrangement of the ducts of the liver. The composition of the bile, and the quantity of that fluid secreted daily. The functions of the bile. The nature and uses of glycogen.

The Spleen and the other Ductless Glands.—The structure and probable functions of these organs.

The Alimentary Canal.—The structure, forms, kinds, and succession of the teeth. The structure and functions of the salivary glands. The structure and functions of the tongue, the soft palate, uvula and tonsils. The pharynx and the œsophagus and the structure of their walls. The stomach, its form; the structure of its walls; its glands and their functions. The divisions of the intestine. The structure of its walls. Villi. Glands. Peyer's patches. The structure and functions of the pancreas. The peritoneum and the nature of the mesentery.

The details of the digestive and absorptive processes. The profits and losses of the economy, and how they are balanced during health.

The Muscular System and Animal Mechanics.—The minute structure of fibrous, cartilaginous, bony, and muscular tissue.

The physical, chemical, and physiological properties of muscle. Rigor mortis. The mechanism of standing, walking, running, and jumping.

The structure and working of the larynx. The mode in which consonantal and vowel sounds and articulate speech are produced.

The Senses.—The structure of the papillæ of the skin, and of the tactile corpuscles. The muscular sense. The minute structure and nervous supply of the tongue as a sensory organ.

The structure of the olfactory organ. The nature and extent of the air chambers connected with it. The minute structure of the Schneiderian membrane and of the olfactory nerve-fibres. The mechanism of smelling.

The structure of the ear. The external ear and the muscles which move it. The muscles connected with the ear bones and their actions. The minute structure of the membranous labyrinth and cochlea. The probable functions of these organs.

The minute structure and the properties of the various constituents and coverings of the eyeball. Complementary colours. Phosphenes. Purkinje's figures. Adjustment. Regulation of light. Double vision with one eye.

Sensations and Judgments.—The notion of roundness. Subjective sensations. Ventriloquism. Erect vision. Double vision and single vision with two eyes. Judgments of distance and form. The pseudoscope and the stereoscope.

The Nervous System.—The structure of ganglionic corpuscles and of nerve fibres. The structure of the investments of the brain and spinal cord. The minute structure of the spinal cord. The general disposition of the histological elements of the brain. The names and positions of the larger divisions of the brain and of its ventricles. The origins and functions of the spinal and cerebral nerves in detail. The effect of cutting the spinal cord in various ways, and of injuries to the medulla oblongata. The effect of removing the hemispheres of the brain. Unconscious cerebration and acquired reflex action.

Reproduction.—The structure of the ovum and of the spermatozoon. The process of yelk division. The formation of the blastoderm and the development therefrom of the body of the embryo, with amnion, allantois, and yelk sac. The nature of the chorion, of the decidua, and of the placenta. The mode in which the fœtus is nourished. The development of the heart and the fœtal circulation. The changes in the circulation which take place at birth. The lacteal glands and lactation. The modifications in the proportions of the body from birth to adult age. The general modifications in the condition of the skeleton from its earliest appearance. The notochord. The process of ossification. The thymus and thyroid glands. The two dentitions.

For the elementary stage—

Lessons in Elementary Physiology, by T. H. Huxley, 18mo., 4*s.* 6*d.* (London, Macmillan, 1868.)

is recommended as a text book.

For the advanced stage, in addition to the above, the following works are recommended :—

A Manual of Physiology, by W. B. Carpenter, 12mo., 12*s.* 6*d.* (London, Churchill, 4th ed., 1865.)

Handbook of Physiology, by W. S. Kirkes, 8vo., 12*s.* 6*d.* (London, Walton and Maberly.)

Examination for Honours.

Candidates will be examined in any subject treated of in the standard English works upon Physiology, such as :—

Principles of Human Physiology, by W. B. Carpenter. 8vo. 26*s*. (London, Churchill, 6th ed., 1864.)

Outlines of Human and Comparative Physiology, by J. Marshall. 3 vols. 12mo. 32*s*. (London, Longman, 1867.)

SUBJECT XV.—ZOOLOGY.

N.B.—Students should have been instructed in the elements of physiology before commencing the study of Zoology. After May 1869 no candidate will be passed in Zoology unless at the same, or at a previous, examination he has been passed in the elementary stage of Animal Physiology.

First Stage or Elementary Course.

Questions will be confined to the following topics :—

The characteristic and distinctive features of the following groups of animals :—*Vertebrata, Mammalia, Aves, Reptilia, Amphibia, Pisces, Arthropoda, Insecta, Myriapoda, Arachnida, Crustacea, Annelida, Echinodermata, Rotifera, Infusoria, Spongida, Foraminifera, Cœlenterata, Hydrozoa, Actinozoa, Polyzoa, Brachiopoda, Lamellibranchiata, Pulmogasteropoda, Branchio-gasteropoda, Cephalopoda.*

(Candidates will be expected to be able to refer any British member of one of these groups to its proper group.)

The general nature and arrangement of the skeleton (or hard parts) in *Foraminifera, Spongida, Hydrozoa, Actinozoa, Brachiopoda, Lamellibranchiata, Gasteropoda, Echinodermata, Arthropoda, Vertebrata.*

The general nature and working of the alimentary apparatus observed in *Infusoria, Hydrozoa, Actinozoa, Polyzoa, Gasteropoda, Annelida, Arthropoda, Pisces, Aves, Mammalia.*

The general structure and working of the organs of circulation and respiration in *Lamellibranchiata, Gasteropoda, Crustacea, Arachnida, Insecta, Pisces, Amphibia, Reptilia, Aves, Mammalia.*

The general nature of the nervous system in *Rotifera, Echinodermata, Annelida, Arthropoda, Polyzoa, Lamellibranchiata, Vertebrata.*

The principal characters of the organs of hearing in *Lamellibranchiata, Crustacea, Pisces,* and *Mammalia;* and of the organ of sight in *Annelida, Arachnida, Insecta, Gasteropoda,* and *Vertebrata.*

The general nature of the process of development in *Hydrozoa, Lamellibranchiata, Crustacea, Insecta, Amphibia,* and *Aves.*

Second Stage or Advanced Course.

Questions may be set in all subjects enumerated under the Elementary Stage, and in addition on the following topics :—

The characters and distinctive peculiarities of the *Nematoidea, Acanthocephala, Turbellaria, Trematoda, Ascidioida* (or *Tunicata*), *Pteropoda, Radiolaria* (or *Polycistina*), *Gregarinida, Rhizopoda;* and of the principal subdivisions (orders) of the *Mammalia, Aves, Reptilia, Amphibia, Pisces, Insecta, Arachnida, Crustacea, Annelida, Echinodermata, Hydrozoa, Actinozoa, Brachiopoda, Lamellibranchiata, Gasteropoda, Cephalopoda.*

Reference of any specimen to its proper class and order.

The most important modifications of the vertebrate skeleton observable in *Pharyngobranchii, Marsipobranchii, Elasmobranchii, Teleostei, Chelonia, Ophidia, Aves, Monotremata, Marsupialia, Cetacea, Cheiroptera, Ungulata, Simiadæ, Man.*

The leading modifications of the appendages of the body and head in the *Arthropoda.*

The structure of the test in *Echinus, Uraster*, and *Comatula* (*Antedon*).

The structure and nomenclature of the parts of the shell in *Brachiopoda, Lamellibranchiata, Gasteropoda*, and *Cephalopoda.*

The structure of the corallum in the *Actinozoa.*

The structure, succession, and chief forms of the teeth in *Mammalia.* The dental formulæ of Man, of old and new world apes; of the hedgehog, the dog, the cat, the horse, the ox, the pig, the rabbit, and the rat.

The structure and mode of formation of "whalebone."

The structure and movements of the beaks of *Aves* and *Chelonia.*

The poison fangs of snakes and the mechanism by which they are moved.

The teeth of ordinary fishes, of sharks, rays, *Chimeræ*, and lampreys.

The alimentary apparatus of the *Ruminantia*, and the mode in which it works.

The leading forms assumed by the circulatory, respiratory, renal, hepatic, and salivary organs in the animal series.

The modifications of the brain and of the sensory organs in the *Vertebata, Arthropoda, Cephalopoda*, and *Gasteropoda.*

The leading forms of the reproductive apparatus, with the general process of development, in *Mammalia, Aves, Reptilia, Amphibia, Pisces, Arthropoda, Annelida, Echinodermata, Trematoda, Tæniada, Spongida, Cœlenterata, Lamellibranchiata, Pulmo-gasteropoda, Branchio-gasteropoda, Cephalopoda.*

The distribution of animals. The principal forms of animal life characteristic of Australia; of South America, with Mexico; of Africa, south of the Sahara; of Hindostan; of Central Asia, with Europe and North Africa; of America, north of Mexico; of the Atlantic, the Indo-Pacific, the Arctic and Antarctic Oceans.

The broad facts relating to the succession of animal life upon the globe.

The natural history of the animals which supply articles of commerce.

Examination for Honours.

In this examination questions will be set at the discretion of the Examiner, who will have regard to the state of Zoological teaching in the country and the means of acquiring information.

SUBJECT XVI.—VEGETABLE ANATOMY AND PHYSIOLOGY.

I. First Stage or Elementary Course.

Distinctions between flowering and flowerless plants. Growth of flowering plant from seed. Plumule, radicle, cotyledons.

Ascending and descending axis: axial and appendicular organs.

Cells: Parenchyma, prosenchyma, ducts, spiral vessels. Vascular bundles.

Structure and growth of root. Spongioles.

Structure of exogenous stem. Pith, wood, bark, medullary rays.
Epidermis. Hairs, prickles.
Nature, position, and development of leaf buds: branches and spines.
Venation and structure of leaves. Stomates.
Floral organs, protective and essential. Sexes of plants.
Structure and dehiscence of anthers. Structure of pollen grain. Evolution and course of pollen tube.
Stigma. Ovule: nucleus and coats, foramen. Anatropous campylotropous and orthotropous ovules. Impregnation. Embryo sac.
Seed: hilum, chalaza, rhaphe. Albumen. Embryo: monocotyledonous and dicotyledonous.
Food of plants. Course of sap, osmose, exhalation, respiration (by day and night), assimilation. Cambium layer.
Composition of cellulose, starch, sugar, gum, gluten, chlorophyll.
In the earlier course these subjects should be taught quite generally, as they occur in the ordinary type of structure. All exceptions should be reserved for the higher course.

Second Stage or Advanced Course.

Cell development by division and free cell formation. Protoplasm. Formation of ducts and vessels.
Cell contents. Cytoblast or nucleus, secondary deposits, air, crystals, rhaphides, chlorophyll, oil.
Circulation of fluids in cells.
Functions of cells and vessels. Intercellular spaces, latex canals.
Structure of trunk of climbing plants, and of tree ferns.
Parasitical plants; leafy and leafless, on root, stem, bark.
Development of leaves.
Abnormal forms of stomates.
Pollen formation.
Ovule of Loranthaceæ.
Impregnation and embryogeny of Conifers and their allies.
Reproduction of Cryptogams.
Propagation of plants otherwise than by seed.
Physiology of flower; absorption of oxygen, evolution of heat.
Irritability of leaves, tendrils, stamens.
Theory of manures.
Differences between animals and plants.

Examination for Honours.

Questions will be set at the discretion of the examiner, who will have regard to the state of botanical learning in the country and the means of acquiring information.

SUBJECT XVII.—SYSTEMATIC AND ECONOMIC BOTANY.

First Stage or Elementary Course.

A.—Morphology.

Ascending and descending axis.
Root: annual, biennial, perennial; fibrous, tuberous, tap, &c.
Stem: woody or herbaceous; erect or creeping; corm, bulb, rhizome.

Leaf: entire or variously cut; simple or compound; kinds of composition. Petiole, blade.

Stipules. Tendrils. Bracts.

Inflorescence: raceme, spike, catkin, umbel, capitulum, corymb, panicle.

Flower: complete or incomplete, uni- or bi-sexual; regular or irregular.

Calyx and corolla: poly- or gamo- sepalous or petalous; persistent or deciduous; valvate, imbricated or twisted in estivation.

Stamens: number and relative position; insertion, cohesion. Filament, anther.

Ovary: adherent or free; of one or more carpels, uni- or multi-locular; number and cohesion of styles.

Ovules: solitary or numerous; erect, horizontal, or pendulous; with axile, free central or parietal placentation.

Fruit: dehiscent or indehiscent; succulent or dry; drupe, berry, achene, capsule, legume, pod.

B.—Classification.

Dicotyledones: thalalamifloræ, calycifloræ, corollifloræ, incompletæ.

Monocotyledones.

Acotyledones: acrogens, thallogens.

Distinctive characters of the largest British natural orders, viz.:—

Ranunculaceæ.	Scrophulariaceæ.
Cruciferæ.	Labiatæ.
Caryophylleæ.	Orchideæ.
Leguminosæ.	Liliaceæ.
Rosaceæ.	Cyperaceæ.
Umbelliferæ.	Gramineæ.
Compositæ.	

C.—Economic Botany.

The candidate will be expected to know the economic plants indigenous to Great Britain and Ireland, as well as those contained in the following list:—

Wheat.	Gum.	Teak.
Barley.	Caoutchouc.	Maple.
Oats.	Gutta Percha.	Walnut.
Rye.	Turpentine.	Opium.
Rice.	Palm oil.	Quinine.
Indian corn.	Cocoanut oil.	Jalap.
Pea.	Castor oil.	Ipecacuanha.
Bean.	Olive oil.	Aloes.
French bean.	Indigo.	Rhubarb.
Pasture Grasses.	Logwood.	Senna.
Clover.	Madder.	Nutmeg.
Turnip.	Catechu.	Cloves.
Mangold.	Galls.	Pepper.
Hops.	Oak bark.	Orange.
Tea.	Cotton.	Vine.
Coffee.	Flax.	Almond.
Cocoa.	Hemp.	Peach.
Chicory.	Jute.	Plum.
Tobacco.	Mahogany.	Melon.
Starch.	Oak.	Cucumber.
Sugar.	Deal.	Gourd.

The use of the product, the part of the plant affording it, the name and natural order of the plant which yields it, its native country when wild, and when cultivated the area of cultivation will be expected to be known.

Second Stage or Advanced Course.

Modifications of stem structure (as in cactus, &c.)
Modifications of leaf structure : Phyllodes, pitchers.
Morphology of cryptogams : frond, thallus, theca or spore-case, sorus, elater, mycelium, spore, &c.
Phyllotaxis.
Theory of Inflorescence.
Metamorphosis of flowers.
Dimorphism of flowers.
Principles of classification.
Natural family or order, genus, species, variety.
Variations of cultivated plants.
Characters of all British natural orders, and of the largest and most important exotic orders.
Classification of Cryptogams : characters of ferns, Lycopodiaceæ, Equisetaceæ, mosses, Hepaticæ, Characeæ, Algae, Lichens, Fungi.
Principal economic plants belonging to each natural order.
General principles of geographical botany.

Examination for Honours.

Questions at the discretion of the examiner, who will have regard to the state of botanical learning in the country and the means of acquiring information.

SUBJECT XVIII.—PRINCIPLES OF MINING.

The Art of Mining embraces so wide a field of study that equal practical proficiency in its various branches is not to be expected from persons engaged in different classes of mines, nor equal knowledge of its general features from students brought up in districts where only one or another branch of the subject is practised. The examination papers will therefore contain a sufficient variety of questions to suit candidates belonging to either a metalliferous or a coal district.

The subject at large being properly an art, or application of various branches of science, and one in which every question will admit of various degrees of proficiency being shown in the replies, the higher numbers will be awarded only to those answers which exhibit the greater amount of completeness and accuracy. Curt and vague answers will be but of little value, and exactness will be expected in all that relates to numbers, prices, weights, and measures.

Those who wish to gain a general knowledge of the topics for examination may be recommended to direct their attention to the subjoined heads, viz. :—

First Stage or Elementary Course.

1. Geology and Mineralogy, more particularly those portions of the sciences which bear on the following subjects,—the nature and position in the earth's crust of the useful minerals, the classes of

rock with which they are severally associated, the special character of heaves, throws, troubles, and all kinds of dislocation; the particular differences between beds and lodes, and their minerals, and the chief features of irregular repositories.

2. The methods of prospecting and searching at surface for ores and other minerals.
3. Breaking rock by manual labour alone; various forms of pick, and of hammer and wedge employed for the purpose. Use of gunpowder and other explosives; precautions to be observed in boring and in firing shots.
4. Depths attained by mines and bore holes in various cases. Geographical distribution of the chief mining districts.
5. Ventilation of mines, why important. Composition of air, carbonic acid gas, and fire-damp; how the latter noxious damps occur, and what precautions against them should be adopted, either for a temporary purpose or permanently. Reasons of a natural circulation of air to some extent being observable in all mines. Various applications of water to aid ventilation. Means of applying heat, or machines for the same purpose.
6. Lighting of workings; principle and construction of the safety lamp.
7. Circumstances under which water enters mines. Working of ordinary pumps; special requirements of pumps for mines. Mode of applying human or horse labour to the winding of water and stuff or mineral; fixing and comparison of the unit of work. Water wheels and steam engines, variety and construction of, as in use for mining purposes.

   Carriage or conveyance along levels and inclines; barrows, tramplates, rails, tubs, or wagons.

   General features of winding in shafts by machinery.
8. The form and dimensions of shafts applied to various purposes; sinking, and precautions against accident from falls and from collapse of sides.
9. Driving of levels, drifts, and wind-roads; their rate of inclination, breadth, and height in various districts; methods and cost of arching them, and of timbering or wooding.
10. The removal or *exploitation* of mineral after completion, to a certain point, of dead work; stopes and pitches, under various circumstances. Pillar-working at various depths, and other forms of extracting coal or ironstone. Main considerations of safety and economy which have to be studied in adopting a particular plan.
11. Means of security to be adopted in shafts; 1st, as to construction and fixing of ladders; 2nd, as to rules and arrangements where the men ride instead of climbing.

Second Stage or Advanced Course.

1. Details as to the form in which the useful minerals are accumulated; stratified deposits; alluvial or stream-works; lodes and their various directions; pipes and other irregular repositories. Examples of remarkable localities; true sectional drawings or profiles to be studied. Examples of heaves, and alleged laws according to which they have taken place. Composition and physical state of the containing rock or "country."
2. Exploring, shoading, and costeaning. Grounds for opinion in the re-opening of old mines; preliminary operations in virgin districts.

3. Breaking of ground; the various implements employed, their form, dimensions, and weight; boring for shots; the various modes of firing charges. Heavy charges, how calculated and fired; rules for ensuring safety. Drilling and coal-cutting machines.
4. Deep boring, under what circumstances applicable,—apparatus for; description of varieties in use; lining of bore-holes.
5. Management and supervision; payment of men employed at mines, at surface and underground, varying in principle with the different classes of operation; reasons for tut-work or piece-work, and tribute or bing-tale under different circumstances. Calculations for cost of driving, sinking, tramming, &c.
6. Physical principles of ventilation; practice of mines where simple natural ventilation is employed; ventilation of large areas and of deep or complicated workings by guiding the natural current; artificial means, and their details, for promoting ventilation. Precautions to be taken under specially dangerous conditions.
7. Illumination, of various kinds, their economy; safety lamps in all their best modifications; circumstances under which they should be employed; precautions in their use.
8. Mechanical division of the subject. Strength of materials used in mines; human and horse power, principles and construction of machines to which they are applied. Hydraulic machines: construction of the water-wheels, turbines, and pressure engines most suitable to the various operations of mining. Steam engines, for pumping and for winding; arrangement and construction of the varieties most in use. Form and dimensions of boilers. Pumps employed in mines, mode of placing them; construction of the lifts; materials and details of the rods, set-offs, counterbalances, cisterns, and catches. Circumstances under which dams are erected in shafts or levels; mode of building them.

   Tubbing of water from shafts; conditions under which it may be done; details of the operation with various materials, wood, brick, stone, cast and wrought iron.

   Rails, waggons, and tubs for underground conveyance; employment of horses and of fixed steam engines for this purpose.

   Raising of the mineral through the shafts; various methods in use; chains, ropes (of hemp or wire), their weight, &c. Details of the best application of drums, cages, guides, keeps, and safety doors. Pulleys and shaft frames or poppet heads; protection against over-winding; safety clutches, &c. in case of breakage of rope.
9. Opening of ground; quarries and open work; driving of levels, various dimensions and directions according to circumstances; sinking of shafts, inclined or perpendicular; advantages of either kind under certain conditions; means of securing levels and shafts by timber or by walling; details of the various methods. Driving or sinking in heavy or running ground.
10. Working excavations; plan of laying them out, and means of security to be adopted whilst they are kept open. This will include the stoping of metalliferous veins, and the various modifications of post and stall, long-work, &c., which are applied to stratified deposits.
11. Travelling in shafts; prevention of accidents by proper fitting and dividing; mode of placing ladders and sollars; lifting machine for men, construction and advantages of.
12. Dressing of minerals. Arrangement of dressing floors. Construction of crusher and stamps; washing of coal; jigging, concentration, and separation of metallic minerals.

Examination for Honours.

Questions will be set at the discretion of the Examiner, who will have regard to a general knowledge of mining as carried on in this and other countries, and may require certificates from employers as to practical work.

The student may be advised among other sources of information to consult the following works:—

Manual of Geology, by J. Phillips. 8vo. 12*s*. 6*d*. (London, Griffin, 1855.)

Laws regulating the Deposition of Lead Ore in Veins, by W. Wallace. 8vo. 25*s*. (London, Stanford, 1861.)

Treatise on Mining Engineering, by G. C. Greenwell. 4to. 50*s*. (London, Spon, 1856.)

Coal and Coal Mining, by W. W. Smyth. 8vo. 7*s*. 6*d*. (London, Strahan, 1869.)

Metallic Wealth of the United States, by J. D. Whitney. 8vo. 16*s*. (London, Trübner, 1854.)

Géologie Appliquée, par A. Burat. 2 vols. 8vo. 17*s*. (Paris, Langlois, 4th ed., 1859.)

Die Lehre von den Erzlagerstätten, von B. von Cotta. 2 vols. 8vo. 15*s*. (Leipzig, Felix, 2nd ed., 1861.)

Besides these the various reports of H. M. Inspectors of Coal Mines, and the evidence given before Committees of the Houses of Parliament on *Accidents in Mines*, may be studied with advantage.

SUBJECT XIX.—METALLURGY.

For the first stage or elementary course the student will be expected to answer questions under the following heads, exclusive of those in italics.

The second stage or advanced course will include these. The student will also be required to make sketches and name unlabelled specimens.

For honours the candidates will be asked questions at the discretion of the Examiner, who will have regard to the present state of metallurgical science as carried on in this and other countries.

Introductory Subjects.

Physical Properties of Metals.—Physical State. Action of Heat. Specific Gravity. Crystallization. Varieties of Fracture. Malleability. Ductility. Tenacity. Toughness. Softness. Elasticity. Conduction of Heat and Electricity. Capacity for Heat. Expansion by Heat. Opacity. Lustre. Colour.

Classification of Metallurgical Processes.—Explanation of the terms ore, "native" veinstuff, matrix or gangue, "dressing." Reduction. Smelting. Flux and Slag. Regulus. Speise. Roasting. Distillation. Sublimation. Liquation.

Slags.—Atomic constitution of silicates. Constitution, external characters, brittleness, toughness, colour, and fusibility of slags. The fusibility of certain compounds not containing silica, aluminates, &c.

Sesquioxide of iron and lime. Fluor spar as a flux. *Melting points of silicates as indicated by the fusion of alloys of gold and platinum. Supposed sulphosilicates.*

Natural Refractory Materials employed in the Construction of Crucibles, Retorts, Furnaces, &c. Fire Clays.—Approximate composition. Mode of testing. Crucibles.—Earthen or clay crucibles. *Stourbridge clay crucibles. Cornish crucibles. London crucibles. Hessian crucibles. French crucibles. Belgian crucibles.* Graphite, black-lead, or plumbago crucibles. Lining crucibles with carbon. Furnaces.—Sefström's blast furnace. *Deville's blast furnace.* Fire Bricks, &c.—Stourbridge fire-brick. Dinas fire-brick. Sand and sandstones.

Fuel.

The calorific power of fuel. Berthier's process of estimating the calorific power of fuel. The calorific intensity of fuel, and theoretical computation. Wood.—Kinds of wood employed as fuel. Elementary composition of dry wood. Proportion of water in wood. Specific gravity of wood. Proportion and approximate composition of the ashes of wood. The rapidity of growth of wood. Weight of wood. Cutting and storing of wood intended as fuel. Peat or Turf.—Specific gravity of peat. Composition of peat. Approximate composition of the ashes of peat. *Proximate composition of peat.* Extraction and desiccation of peat. Coal.—Definition of coal. Approximate composition of the ashes of coal. Lignites. *Classification of lignites according to external characters.* Approximate composition of lignites. Bituminous coals. Caking coal. Free burning coal. Cannel coal. Anthracite. *Fibrous and granular matter in coals.* Composition of bituminous coals to be given generally and approximately for each class. *The occurrence of certain metals in peat and coals. Frémy's chemical researches on combustible minerals.* Charcoal.—*Specific heat* and specific gravity of charcoal. Proximate composition of charcoal. Various modes of charcoal burning. Charcoal burning in piles or stacks. *Chinese methods of charring in pits.* Yield of charcoal by volume and by weight. Influence of temperature upon yield. *Theory of charcoal burning in circular and rectangular piles.* Peat charcoal or coke. *Carbonization by superheated steam.* Coke.—Properties of coke. Approximate composition of coke. Presence of water in coke. General principles concerning the preparation of coke. Coking in circular piles, in long piles or ridges, and in large open rectangular kilns. Coke ovens. *Cox's coke oven. Coke oven of the Brothers Appolt. Composition and economic application of the waste gases of coke ovens. Davis' Breezeoven. Mineral charcoal.* Coking of non-caking coal slack by admixture with pitch. *Collection of products of economic value generated during the process of coking.* Desulphurization of coke. Combustible Gases.—Carbonic oxide. Hydrogen. Hydrocarbons.

Comparison of fuels in regard to calorific power. *Calorific power calculated from ultimate composition.*

Copper.

Physical and chemical properties. Specific heat. *Linear dilatation by heat.* Action of heat. Atomic weight. Action of oxygen. Dioxide; protoxide; dioxide and protoxide of copper heated with silica. *Borates of copper.* Disulphide. Disulphide of copper heated with access of air. Theory of the process of heating disulphide of copper with free access of air, or roasting. Disulphide of copper heated in admixture with dioxide, protoxide, or sulphate of copper. *Dioxide of*

copper heated with protosulphide of iron and silica. Disulphide of copper exposed to the action of hydrogen and water at high temperatures. Metallic copper exposed to the action of the vapour of water at high temperatures. Disulphide of copper heated with carbon, with iron, with zinc, with lead, with tin, with antimony. Copper heated with tersulphide of antimony. Disulphide of copper heated with nitre, with caustic soda, with carbonate of soda, with baryta or lime, with cyanide of potassium. Copper and dioxide of copper. Copper and carbon. Overpoled copper. Copper and nitrogen. Copper and phosphorus. Copper and arsenic. Copper and silicon. Specific gravity of copper. *Electric conductivity of copper. Influence of various foreign matters on electric conductivity.*

Ores of Copper.—Physical characters and chemical composition of: Native copper. Red oxide of copper. Black oxide of copper. Green carbonate of copper or malachite. Blue carbonate of copper. Vitreous or grey sulphide of copper. Purple copper ore. Copper pyrites or yellow copper ore. True grey copper ore or fahlerz. Chrysocolla. Atacamite. Copper ores of Cornwall and Devon. *Meaning of the word Standard.*

Assaying of copper ores by dry and wet methods. Comparative results by Cornish and wet methods.

Copper Smelting.—In Reverberatory furnaces: The Welsh Process.—Furnaces employed; calciner, melting furnace. The reactions which occur in the process. Calcination; *composition of the gaseous products which escape from the ore-calciner.* Melting of the calcined ore; external characters, and composition of coarse metal and ore-furnace slag. *Specific gravity of the coarse metal and ore-furnace slag.* Calcination of the granulated coarse metal; Melting of calcined granulated coarse metal; white metal, blue metal, metal-slag. Moss-copper. Roasting; blister-copper, roaster-slag. *Best selected process.* Refining. *Elimination of the following Foreign Metals during the Welsh Process of Copper Smelting.—Arsenic, antimony, tin, nickel, cobalt, gold, and silver. Various proposed improvements in Copper Smelting Furnaces. Napier's process. Method of smelting proposed by MM. Rivot and Phillips. Smelting rich copper slags in a blast furnace.* In Blast Furnaces: In Japan. In Sweden.—Furnaces employed; ore-furnace, black copper furnace, refining-hearth. The processes of roasting or calcination, fusion of the roasted ore, roasting of the regulus from the last operation, fusion for black copper, refining, and toughening. Copper rain. Loss in smelting. *Smelting of copper schist in Prussian Saxony. Copper smelting in Perm in Russia. Cupriferous pig iron. Theory of the process. Kernel-roasting at Agordo.—Composition of the ore. Roasting. Styrian kilns. Mode of charging. Changes which the ore undergoes during roasting. Theory of the process. Wet methods of extracting copper:—Precipitation of copper from solution by iron. Bankart's process. Wet process by M. Escalle. Hähner's patent.*

Loss of copper. Impurities occurring in commercial copper.

Zinc or Spelter.

Physical and *chemical* properties. Atomic weight. Action of oxygen. Action of water on zinc. Oxide of zinc. Reduction of oxide of zinc by carbon, carbonic oxide, and hydrogen. *Silicates of zinc. Reduction of silicate of zinc by carbon. Oxide of zinc heated with boracic acid.* Sulphide of zinc heated with access of air, with oxide of zinc, *with carbon, with various metals, in the vapour of water, with carbonic acid,* with nitre or nitrate of soda, with carbonate of potass or soda, *with lime.* Zinc and phosphorus. Zinc and arsenic.

Ores of Zinc.—Physical character and chemical composition of: Calamine. Electric calamine. Blende. *Red zinc ore.*

Methods of assaying Ores of Zinc.

Methods of Extracting Zinc.—*English Process.—Roasting or calcination of the blende. Pots and condensing tubes. Reduction house. Mode of making the pots. Mode of charging the pots, and management of the furnace. Treatment of the rough zinc.* Silesian Process.—Retorts and appendages. Clay nozzles or condensers. Laggins or stoppers. Iron appendages. Description of the furnace. Calciner. Distillation of zinc. Melting of distilled zinc. Belgian Process.—Retorts and appendages. Description of the furnace. *Carinthian Method. Zinc fume. Montefiori furnace.* Foreign matter in commercial zinc. *Proposed improvements in the extraction of zinc.*

Brass.—Definition. Malleability. Process of stamping. Dead-dipping. Physical properties of various alloys of copper and zinc. Manufacture of calamine brass. Direct preparation of brass. Muntz's metal. Defects occurring in brass. Colouring and lacquering.

IRON.

Physical and Chemical Properties. Magnetism. Tenacity or tensile strength. Specific heat. *Dilatation by Heat.* Action of heat. Welding. "Burnt Iron." Crystalline and fibrous iron. Effect of cold hammering upon iron. Atomic weight. Iron and oxygen.—Protoxide; sesquioxide or red oxide; hydrated sesquioxide; magnetic oxide; iron scale, or hammer slag. *Ferric Acid.* Iron and Water.—Preservation of iron from rust. Iron and Sulphur.—*Disulphide;* protosulphide; *protosulphide exposed to the action of vapour of water at a high temperature. Protosulphide of iron heated with carbon, with sesquioxide of iron, with sulphate of protoxide of sesquioxide of iron, with protoxide of lead, with other metallic sulphides, with silica, with silica and carbon. Sesquisulphide;* bisulphide; or iron pyrites. Magnetic pyrites. Sulphate of protoxide of iron, copperas, or green vitriol. *Neutral tersulphate of sesquioxide of iron.* Sulphides of iron roasted with access of air. Iron and Nitrogen.—Results of experiments. *Passivity of iron.* Iron and Phosphorus.—Phosphides of iron. *On the action of carbon on iron containing phosphorus.* Phosphate of protoxide of iron. Phosphate of sesquioxide of iron. *On the action of iron at a high temperature upon phosphate of lime in the presence of carbon.* Ditto in the presence of carbon and free silica. *On the action of phosphorus on iron containing sulphur. Iron and Arsenic. Case-hardening of iron or steel by arsenic.* Silicon. *Silicon and nitrogen.* Manganese and Silicon. Iron and Silicon.—Reduction of silica by carbon in the presence of oxide of iron and other bases. Protoxide of iron and silica. Reduction of silicate of protoxide of iron by carbon. *Silicate of sesquioxide of iron. Tribasic silicate of protoxide of iron heated with access of air. Liquation of silicate of protoxide of iron containing phosphorus. Protoxide of iron and boracic acid. Sesquioxide of iron and boracic acid.* Iron and Carbon.—Modes of effecting the combination of carbon with iron. Cementation. *Action of carbonic oxide upon iron. Action of solid carbon upon iron. In an atmosphere of carbonic oxide. In an atmosphere of hydrogen.* Amount of carbon in iron. Maximum amount of carbon capable of being taken up by pure iron. *Iron, manganese, and carbon.* Modes of existence of carbon in iron, grey, white, and mottled cast iron. Chill-casting. Spiegeleisen, or specular cast iron. *Action of silicon and of sulphur on iron containing carbon. Abstraction of silicon from cast iron by fusion with sesquioxide of iron alone, and with the addition of manganese.* Carbonate of protoxide of iron. *Action of dilute sulphuric or hydrochloric acid on white and grey cast iron.* Action of sea water on cast iron.

Alloys of Iron.—Iron and copper. Iron and zinc. Process of zincing

or galvanizing iron. Iron, copper, and zinc. Keir's patent. *Aich-metal. Sterro-metal.* Iron and tin. *Hardening the tops of rails with tin. Stirling's patent. Action of tin on cast iron.* Iron and manganese; *titanium; lead; bismuth; nickel; cobalt; mercury; silver; gold; platinum; rhodium; aluminium; chromium; tungsten.*

Ores of Iron.—Physical properties and chemical composition of:—Magnetic oxide of iron, magnetite. *Franklinite.* Red hæmatite, red ore or anhydrous sesquioxide of iron. Brown hæmatite, brown iron ore, or hydrated sesquioxide of iron. Spathic carbonate, or sparry iron ore. Argillacious iron ores, clay or clayband ironstones.

Assaying of iron ores by dry and wet methods.

Direct Extraction of Iron in the Malleable State from the Ore.—Iron Smelting in India, Burma, Borneo, Africa, and Madagascar. Catalan Process; trompe, or blowing machine. *Its advantages and disadvantages.* Water wheel, hammer, and anvil. *Theory of the process. Conditions affecting the quality of the iron produced.* Characters of the iron produced. *The Osmund furnace.* Stückhofen or High Bloomery Furnace. *Clay's process. Renton's process. Chenot's process.* Indirect Extraction of Iron in the State of Cast Iron from the Ore.—*Swedish charcoal blast furnace; mine kiln. Pressure of the blast. Temperature of the blast. Iron ores employed. Most important iron mines in Sweden. Smelting of lake and bog iron ores in Sweden.* Description of the modern blast furnace; foundation, hearth, twyer openings, twyer, tunnel head, bracing, blast main, and blast pipes, *blast engines.* Cinder tubs. *Chemical phenomena of the modern blast furnace.* Hot Blast.—Neilson's patent. When first put into operation. Apparatus for heating the blast. *Neilson's first apparatus. Cast-iron tubular oven.* Syphon pipe, *box-foot pipe, spiral pipe, and pipe-within-pipe oven. Gas oven. Round or oval oven. Theory of the hot blast.* Saving of fuel. *Water-twyers.* The Gases of Iron-smelting Blast Furnaces.—Composition of the gases of the Furnace. *Production of cyanogen in the blast furnace. Temperature of the blast furnace at different depths.* Utilization of the gases escaping from blast furnaces. "The waste gas." Modes of taking off the gases with open-mouthed and with close-mouthed furnaces. *Solid matter carried over with the waste gas.* The best form of the blast furnace. Decrease in volume which the materials undergo during their descent. Elliptical furnace. *Rectangular or Rachette furnace. Blowing in a blast furnace.* Tapping. Sand-bed for casting. Derangements in the working, scaffolding, and slips. Loss of iron in the slag. *Indications afforded by colour of slags. Spontaneous disintegration. Potash in slags. Accidental products of blast furnaces. Silica. Furnace cadmia or calamine. Cyanonitride of titanium. Graphite or kish.* Reduction of phosphoric acid in the blast furnace, and passage of the phosphorus into the pig iron. Economical application of blast furnace slags. *Effects of long continued heat upon sandstone in the hearth bottom. Substitution of lime for limestone as a flux. Application of chloride of sodium.* Explosions in blast furnaces. Poisoning by gas accidentally escaping from blast furnaces. Yields of blast furnaces.

Various kinds of Pig Iron.—Spiegeleisen. Pig iron made from magnetic iron ore. Do. from red hæmatite. *Do. from brown hæmatite. Pig iron produced exclusively from Northamptonshire ore.* Do. wholly or chiefly from argillaceous iron ore of the coal measures. *Yorkshire. Derbyshire. South Staffordshire. North Staffordshire. South Wales. Do. from Cleveland ore. Titaniferous pig iron.*

Production of Malleable Iron from Cast Iron.—South Welsh process; the hollow fire. Swedish Lancashire Hearth; *Walloon process, as conducted in Sweden. Carinthian process.* Slags or cinders produced in finery processes. Running out fire or refinery; composition of refined

iron; do. refinery slags or cinders. Puddling; puddling furnace. Invention of iron bottoms; manipulation; theory of the process; composition of tap cinder; invention of the boiling process; double puddling furnaces. *Mechanical puddling. Application of waste blast furnace gas to puddling. Siemens' gas puddling furnace; principle of the furnace. The gas producers. Construction. Puddling with dried wood. Stamping and assorting puddled balls. Utilization of the waste heat of puddling furnaces.* Working of the Ball.—Forge hammers; tilt hammers. Helves or lift hammers. *Steam forge hammers; Nasmyth's. Condie's.* Squeezers; crocodile. Horizontal rotary. Vertical rotary. *Brown's shingling machine.* Puddling or puddle rolls. *Composition of puddled bars.* Working of the Puddled Bar into Merchant or Finished Iron.—Reheating furnace; with coal as fuel. With gaseous fuel, or gas-welding furnace. Piling. Accidents in rolling mills. *Yield of puddled and finished iron.* Manufacture of rails. *Composition of the cinder from the reheating furnace.*

Varieties of Sheet Iron and Slit Rods.—Tin plates. Charcoal plates. *Coke plates. Belgian sheets. Russian sheets. Slit rods.* Special Qualities of Iron.—South Yorkshire. Process of manufacture at Lowmoor, Bowling, and Farnley. South Staffordshire. *Swedish iron. Dannemora. Russian iron.* Boat plates. *Armour plates; rolled; hammered. Mending broken rolls.*

Permanent expansion of cast iron by exposure to long continued heat at or above redness. Dilatation of cast iron by heat.

Production of Steel.—By the Addition of Carbon to Malleable Iron: In the direct reduction of iron ores at one operation. In the Catalan process. In crucibles. In converting furnaces. Carburization of iron as a distinct process; carburization of pulverulent iron. *Chenot's process.* Carburization of bar iron. Converting furnace. *Carburization by gaseous compounds of carbon.* Carburization by fusing compact iron with carbonaceous matter; *Hindoo process. Wootz. Mushet's steel.* By the partial Decarburization of Cast Iron:—By fusing in hearths. *By puddling.* Composition of puddled steel. *Uchatius process.* By cementation. By Fusion of Pig Iron with Malleable Iron:—*Immersion of malleable iron in molten cast iron.* By Blowing Atmospheric Air through Molten Pig Iron.—Bessemer process. Description of the apparatus. *Parry's process of manufacturing iron and steel.* Casting of Steel.—Furnaces and crucibles. Fusion of steel in the reverberatory furnace. *The addition of manganese in the casting of steel.* Manipulation of Steel.—Hardening and tempering steel. *Metallic baths for the use of working cutlers.* Theory of hardening and tempering steel. Hammering steel. Welding steel. Shear steel. *Casting steel on wrought iron. Damaskeening.*

Lead.

Physical and Chemical Properties. *Dilatation by heat. Conductivity for heat and electricity.* Action of heat. Autogenous soldering. Action of air, of water, *of carbonic acid, of dioxide of copper, and of acids upon lead.* Protoxide; mode of formation by dry and *wet* methods. Physical characters of massicot and litharge. Action of heat. Action of carbon, *of hydrogen, and of carbonic oxide.* Fusibility with metallic oxides. *Action of metals when heated with protoxide of lead. Dioxide;* Binoxide; mode of formation. *Sesquioxide;* Red lead; process of manufacture. Physical and *chemical* properties. Action of heat. *Action of acids.* Sulphide; physical and chemical properties. Action of heat and air upon sulphide of lead; in the presence of iron pyrites and of blende. *Action of hydrogen and of steam upon sulphide of lead.* Action of protoxide

of lead, silicates of protoxide of lead, *of alkalies, of carbonate of soda,* of cyanide of potassium, of alkalies and alkaline carbonates and carbon, of lime and carbon, *of peroxide of iron and carbon,* of nitrate of potash, *of chloride of sodium,* of iron, *of tin,* and *of copper* when heated with sulphide of lead. Combination of sulphide of lead with other sulphides. *Subsulphides of lead.* Sulphate; physical and *chemical* properties. Action of heat. Action of carbon, of iron, of lead, of protoxide of lead, of sulphide of lead, *of chloride of lead,* of silica, of lime, of *chloride of sodium,* and of cyanide of potassium, upon sulphate of lead. *Sulphate of lead and fluor spar.* Lead and Phosphorus. Phosphide; phosphates. Lead and Arsenic. Action of arsenious acid on lead. Arseniate of lead. Silicates of Protoxide of lead. Methods of formation. Fusibility. Action of carbon, of sulphur, *of sulphide of iron,* of iron, *of lime, of lime and carbon,* of peroxide of iron and carbon upon silicates of protoxide of lead. *Silicates of protoxide of lead and potash. Silicates of protoxide of lead and lime. Silicates of protoxide of lead, lime, and alumina. Borates of protoxide of lead.* Carbonate; white lead. Action of heat.

Alloys of Lead.—Lead and antimony; zinc; *copper; mercury; gold;* silver.

Ores of Lead.—Physical character and chemical composition of: Galena or sulphide of lead. Cerusite, or carbonate of protoxide of lead. Anglesite or sulphate of protoxide of lead. Pyromorphite or phosphate of protoxide of lead. Mimetisite or arseniate of protoxide of lead. Minerals occurring with galena.

Methods of assaying Lead Ores.

Extraction of Lead from the Ore.—In air furnaces: Old English process. *Peruvian process. Spanish process.* In blast furnaces: *Hindoo process.* Ore hearth.—Construction of the furnaces, method of working, nature of the products, *chemical composition of the products and chemical reactions which occur in the process. American ore hearth.—Peculiarity. Advantages.* German method with iron, or "precipitation process."—Description of furnaces, mode of working, nature of the products, *chemical composition of the products and chemical principles involved. Composition of lead speise.* Smelting of regulus. German method with silicate of protoxide of iron, or iron refinery slags. In reverberatory furnaces: Derbyshire furnace.—Process, description of the furnace, nature and *composition of the products and chemical reactions involved.* Flintshire furnace.—Process, peculiarities, nature of the products, *chemical composition of the products and chemical reactions which occur. Action of lime.* Cornish process.—Description of "calciner," and of "flowing furnaces." Nature of the products. *Chemical composition of products. Action of iron.* Bleiberg process.—Peculiarities of the process, character of furnace. Method of working, nature of the products and *chemical composition of products. Modifications of process.* Smelting of lead slags: Slag hearth.—Description of furnace, mode of working, *composition of products and chemical reactions involved.* Spanish slag hearth.—Description of furnace, mode of working, nature of products and *chemical composition of products.* Smelting of lead fume. Reduction of litharge. Softening of hard lead. Smelting of sulphate of protoxide of lead ore. *Composition of the products.*

Extraction of Silver from Lead.—Pattinson's process.—*Theory of the process,* methods of working, description of the apparatus and mechanical appliances. *Limit of concentration. Effect of foreign metals.* Parkes' process.—Methods of working. *Principles involved.* English process of cupellation.—Construction of furnace, mode of conducting the process, nature of the products, *chemical composition of the products and chemical reactions involved.* German process of cupellation (abtreiben).—Description of furnace, mode of conducting the process,

nature of the products and *chemical composition of products.* Refining of "Blicksilber."—In open test. Under a muffle.

Apparatus for condensing Lead Fume. Physical properties and *chemical composition* of lead fume. Varieties of Lead in Commerce. Impurities occurring in lead. *Methods of testing for metals present in lead.*

Silver.

Physical and chemical properties. *Dilatation by heat. Conductivity for heat and electricity. Specific heat.* Action of heat, of heat and air, of nitre, *of chloride of sodium, of oxide of copper,* of protoxide of lead, *of sulphate of protoxide of copper,* and of acids upon silver. Silver and Oxygen. Protoxide; physical and chemical properties. Methods of producing. Action of heat. Action of carbon. *Action of chlorine.* Silver and Sulphur. Sulphide; physical and chemical properties. Modes of formation. Action of heat. Action of heat and air. Action of heat and air in the presence of iron pyrites, copper pyrites, *disulphide of copper, blende, and galena. Action of hydrogen, of steam,* of acids, of nitre, of iron, of lead, *of copper, and of mercury upon sulphide of silver.* Combination with other sulphides. *"Oxidized silver" process.* Sulphate; physical and chemical properties. Mode of producing. Action of heat. Action of chloride of sodium. Mode of formation of compound of sulphide and sulphate of silver. *Solubility in water. Sulphite;* hyposulphite; method of preparation. *Action of hydrochloric acid upon.* Action of hyposulphite of soda on chloride of silver. Nitrate; physical and chemical properties. Action of heat. Method of separation from nitrate of protoxide of copper. *Action of carbon and phosphorus upon solutions of.* Silver and Chlorine. Chloride; physical and chemical properties. Methods of formation by dry and wet processes. Methods of reduction by carbonate of soda, by carbonate of lime, by zinc. *Action of hydrogen,* of acids, of chloride of sodium, *of cyanide of potassium,* of iron, lead, *copper, tin, antimony, arsenic, mercury,* of sulphur, of metallic sulphides, and of protoxide of lead upon chloride of silver. *Silver and bromine. Silver and iodine. Silver and phosphorus. Silver and arsenic.*

Alloys of Silver.—Silver and lead; copper; gold; *zinc; palladium; antimony.*

Ores of Silver.—Physical characters and chemical composition of: Native silver. Silver glance or sulphide of silver. Sulphide of silver and copper. Antimonial silver. Ruby silver or sulphide of silver and antimony. Brittle silver glance. Sulphide of silver and arsenic. Polybasite. Sulphide of silver, antimony, and lead. Horn silver or chloride of silver. *Bromide of silver. Iodide of silver. Nature of metalliferous minerals containing silver.*

Assaying of ores and alloys of silver by the dry and wet methods.

Methods of Extraction.—Extraction of silver from argentiferous copper: Liquation process, or "Saigerarbeit."—Description of furnace. Mode of operation. Nature of the products. *Chemical principles involved.* Extraction of silver from the ore: Mexican amalgamation process.—Apparatus employed, materials used, method of working, nature of the products and *chemical principles involved. Specialties of the process.* Working of the silver amalgam. *Application of copper amalgam. Loss of silver in the process. Chloride of silver process.* Freiberg amalgamation process.—Description of furnaces and apparatus, Mode of working and *chemical principles involved. Composition of silver amalgam.* Method of separating the silver from the amalgam. *Amalgamation of argentiferous speise. Amalgamation of argentiferous copper*

regulus. Extraction of silver from argentiferous regulus: Ziervogel's process.—Description of the furnaces and apparatus employed, method of operation, nature of the products, and *chemical reactions involved in the various operations. Specialties of the process.* Augustin's process.—Description of the process and *chemical principles involved.* Von Patera's method.—Apparatus used, materials employed, products obtained, and *chemical reactions in the process.* Extraction of silver from ore by means of lead: Furnaces used, method of working, nature of the products. *Chemical composition of the products and chemical reactions involved.* Methods of plating or silvering: Old methods. On copper. On steel. Method of silvering without the use of "batteries." *Stripping of silver plate.*

Varieties of silver in commerce. Metals occurring in silver. *Methods of testing silver for foreign metals.*

Gold.

Physical and chemical properties. Dilatation by heat. *Conductivity for heat and electricity.* Action of heat. *Protoxide; physical properties, mode of preparation, action of hydrochloric acid.* Teroxide; physical and chemical properties. Protosulphide; methods of formation, physical characters. Tersulphide; mode of producing, physical characters, action of heat, *of chlorine, of hyposulphite of soda, and of potash upon tersulphide of gold. Gold and phosphorus. Gold and arsenic.* Gold and chlorine; *protochloride;* terchloride; methods of formation. Action of oxalic acid, of sulphate of protoxide of iron, *of terchloride of antimony and of chloride of arsenic* on solutions of chloride of gold. *Preparation of purple of Cassius. Method of colouring "ruby glass."*

Alloys of gold.—Gold and copper; *zinc;* silver; lead; *tin; antimony; iridium; platinum; palladium;* copper and zinc; silver and copper.

Use of the touchstone. Definition of the terms "standard" and "carat."

Ores of Gold.—Native gold; physical character and chemical composition. *Various metalliferous minerals containing gold.* Auriferous quartz.

Assaying of ores and alloys of gold by dry and wet methods.

Methods of Extraction.—Amalgamation of quartz containing gold; apparatus employed, mode of working, nature of the products, and method of extracting the gold from the amalgam. *Longmaid's process. Anossow's process by means of iron. Plattner's process by chlorine.* Melting of gold dust. Sweep refining.

Separation of Gold from Silver and Copper. Parting.—Dry methods: *By litharge and sulphur.* By cementation; description of the process. *Chemical reactions involved. By sulphur.* Wet methods: Nitric acid process; apparatus used, method of working, and *chemical principles involved.* Sulphuric acid process; apparatus employed, mode of working, and *chemical reactions involved. Modifications of the process. Refining gold containing silver by chlorine.*

Varieties of Gold in Commerce. *Methods of detecting copper, silver, lead, tin, antimony, platinum, palladium, and iridium in gold.*

Mercury or Quicksilver.

Physical and chemical properties. Action of heat, of air, *of acids, and of chlorine upon mercury. Suboxide; physical and chemical properties.* Protoxide or red oxide; mode of formation, physical and *chemical* properties. Action of heat. *Subsulphide; physical and chemical properties.* Protosulphide or vermilion; methods of preparation, physical and

chemical properties. Action of heat, of heat and air, *of hydrogen*, of iron, of lime, *of alkalies, of chlorine, and of acids upon protosulphide*. Subchloride; physical and *chemical* properties. Protochloride; physical and *chemical* properties.

Amalgams.—Mercury and silver; gold; copper; *iron;* sodium.

Ores of Mercury.—Physical characters and *chemical composition* of: Native mercury. Cinnabar. *Native amalgan. Fahlore containing mercury. Nature of other minerals containing mercury.*

Methods of assaying of ores of mercury.

Methods of Extraction.—Description of furnace, method of operation, nature of the products, and *chemical reactions involved* in the following methods: *Huanacavelica process. Almaden process. Idrian process.* Leopold furnace process. Alberti process. Hähner's furnace process. *Gallery furnace process. Fahlore process.*

Impurities present in mercury. Methods of testing mercury for foreign metals. Modes of purifying commercial varieties of mercury. Water gilding.

Cobalt.

Physical and *chemical* properties of the metal. Methods of preparation. Protoxide; mode of formation, physical and *chemical* properties. *Action of hydrogen.* Sesquioxide; methods of preparation, physical and *chemical* properties. *Action of carbon.* Physical and *chemical* properties and mode of producing the compounds of cobalt and arsenic. *Arseniate of cobalt.*

Ores of Cobalt.—Physical character and *chemical composition* of: Cobalt glance. Smaltine. *Cobalt bloom. Nature of other minerals containing cobalt.*

Methods of estimating cobalt.

Cobalt products.—Smalts; mode of preparation. Apparatus used. Nature of the products. *Chemical composition of the products. Chemical principles involved* in the manufacture. Uses of smalts and oxide of cobalt. Silicate of protoxide of cobalt; mode of obtaining. Physical characters. *Rinmann's green; mode of preparation. Nature of. Chemical composition. Thenard's blue; mode of preparation. Nature of. Chemical composition. Phosphate of cobalt.* Printers' blue; application. Mode of preparation. Nature of. *Chemical composition.*

Nickel.

Physical and *chemical* properties of the metal. Physical and *chemical* properties of protoxide and peroxide of nickel. *Action of hydrogen. Action of carbon.* Physical and *chemical* properties and mode of obtaining compounds of nickel and sulphur. Physical and *chemical* properties of the compounds of nickel and arsenic. Nickel speise; *chemical composition. Pottery nickel. Action of heat and air upon arsenide of iron, cobalt, and nickel.*

Alloys of Nickel.—German silver; mode of preparation, physical characters and composition of the commercial varieties. *Nature and composition of other alloys containing nickel.*

Ores of Nickel.—Physical characters and *chemical composition* of: Kupfernickel. Nickeliferous pyrites. Arsenical nickel. Nickel glance. *Millerite. Nature of other minerals containing nickel. Meteoric iron.*

Methods of assaying nickel ores.

Methods of Extraction.—Apparatus employed, mode of working, nature of the products, and *chemical reactions involved.*

Commercial varieties of nickel. *Foreign metals occurring in nickel.*

Arsenic.

Physical and *chemical* properties. Action of heat, and of heat and air upon the metal. Physical and *chemical* properties, and methods of preparation of the compounds of arsenic and oxygen. *Action of light.* Action of heat. Action of carbon, of *hydrogen,* and of *carbonic oxide upon arsenious acid.* Physical and *chemical* properties, and methods of obtaining the compounds of arsenic and sulphur. Action of heat, *of carbonate of soda and carbon, and of cyanide of potassium upon the sulphides of arsenic.*

Ores of Arsenic.—Physical characters and *chemical composition* of: Native arsenic. Realgar. Orpiment. Mispickel. Arsenical iron pyrites. *Nature of other minerals containing arsenic.*

Methods of estimating arsenic.

Methods used for obtaining White Arsenic.—Description of apparatus, methods of working, nature of the products and *chemical reactions involved.* Methods of refining white arsenic; description of apparatus, mode of working, and nature of products. *Preparation and chemical composition of yellow arsenic glass. Preparation and chemical composition of red arsenic glass.* Preparation of metallic arsenic.

Applications of arsenic and its various compounds. Nature and *chemical composition* of Emerald Green and *Scheele's green. Opalescent glass. Mode of producing Green bronze.*

Antimony.

Physical and *chemical* properties of the metal. Physical and *chemical* properties, and methods of formation of the following oxides of antimony:—Teroxide; action of carbon, *of cyanide of potassium,* and of sulphur, upon teroxide of antimony. Intermediate oxide. Antimonic acid; action of heat. Tersulphide; methods of formation. Physical and *chemical* properties. Action of heat, of heat and air, *of steam,* of carbon, of *carbonic oxide,* of cyanide of potassium, of nitre, of iron, of *copper,* of *tin,* and *of acids* upon tersulphide of antimony. Glass of antimony. Liver of antimony.

Alloys of Antimony.—Antimony and lead. Action of heat and air upon alloys of antimony and lead. *Antimoniates of protoxide of lead. Naples yellow.* Composition of type metal and stereotype metal. *Antimony and iron; copper;* "*Regulus venus*" tin. *Other alloys containing antimony used in the arts.*

Ores of Antimony.—Physical characters and *chemical composition of: Native antimony.* Antimony glance. Valentinite. Antimony ochre. *Red antimony ore. Nature of other minerals containing antimony.*

Assaying of ores of antimony.

Methods of Extraction.—Apparatus used, methods of working, nature of the products, *Chemical composition of the products,* and *chemical reactions involved* in the following methods:—Liquation process. Reduction by iron, English process. French method.

Foreign metals occurring in antimony. Methods of testing for foreign metals.

Tin.

Physical and *chemical* properties of the metal. Action of heat, of air, of heat and air, and *of acids* upon the metal. *Action of tin on various metallic oxides.* Physical and *chemical* properties of the following:—Protoxide; *Sesquioxide;* Binoxide; "*Putty powder.*" *Stannate of soda.* Physical and *chemical* properties of the following:—Protosulphide *Persulphide; Protochloride; Perchloride.* Tin and Arsenic.

Alloys of Tin.—Tin and copper. Physical properties and composition of bronze, Bell metal, and Speculum metal. Casting of Bronze. Tin and antimony. Britannia metal. *Tin and zinc.* Tin and lead. Pewter. Solder. Soldering. *Tin, lead, and copper. Roman pot metal. Other alloys employed containing tin. Bearing metal. Amalgam for electrical machines. Tin bronze. Tinning of brass pins.*

Ores of Tin. — Nature and *chemical composition* of Cassiterite. "Stream tin." "Mine tin." "Wood tin." *Tin pyrites or bell-metal ore. Minerals occurring with tin ores.*

Assaying of tin ores.

Smelting of Tin Ores.—In reverberatory and blast furnaces. — Description of furnaces used, methods of working, nature of the products, *chemical composition of the products, and chemical reactions involved.* Refining of tin. *Oxland's process.*

Commercial Varieties of Tin.—Common tin. Refined tin. Grain tin. Block tin. *Foreign metals occurring in tin. Methods of testing for foreign metals.*

Bismuth.

Physical and *chemical* properties. Action of heat, of air, *of steam, and of acids* upon bismuth. Teroxide; mode of formation. Physical and *chemical* properties. Action of carbon. *Protoxide.* Tersulphide; methods of formation. Physical and *chemical* properties. Action of heat. *Action of hydrogen. Action of metals when heated with Tersulphide of Bismuth.*

Alloys of Bismuth.—Nature and composition of alloys containing bismuth employed.

Ores of Bismuth.—Names of various minerals containing bismuth. *Physical characters and chemical composition of minerals containing bismuth.*

Methods of estimating bismuth.

Methods of Extraction.—Apparatus used. Description of processes, *and chemical actions involved in the various methods. Old methods.* Recent methods. Plattner's furnace.

Foreign metals occurring in bismuth. Methods of testing for foreign metals.

Platinum.

Physical and *chemical* properties of the metal. *The properties of Platinum black and Spongy platinum, and methods of formation.*

Ores of Platinum.—Native platinum. Physical characters. *Metals occurring in. Minerals associated with.*

Methods of Extraction.—Wet method. Deville's method. Melting of platinum. *Working of platinum.*

SUBJECT XX.—NAVIGATION.

First Stage or Elementary Course.

General Notions.—Figure of the earth; earth's diameter, axis, poles. Meridians; equator, equinoctial. Parallels of latitude; latitude, longitude. Difference of latitude; difference of longitude. Rhumb line; course; nautical distance, meridian distance; departure.

Examples of differences of latitude and longitude. The meridian distance is equal to the difference of longitude multiplied by cosine of

latitude. When a ship is sailing on a parallel of latitude :— (1), given the distance made good and latitude to find the difference of longitude; (2), given the difference of longitude and the latitude to find the distance; (3), given the meridian distance and the difference of longitude to find the latitude.

The Compass.—Description; Points. Number of degrees, minutes, and seconds in a point, ½ point, ¼ point, ¾ point. To reduce points and parts of points into degrees, minutes, and seconds, and conversely.

Variation of the Compass: easterly, westerly. How to be allowed (1) when it is required to find the true from compass course; (2), to find compass course from true.

Causes of Local Deviation.—How the amount of local deviation is ascertained practically; how allowed. Examples of correction of courses for variation and deviation.

Leeway.—Definition. Starboard tack, port tack, close-hauled. How leeway is to be allowed. Examples.

The Log.—Description. How divided.

Plane Sailing.—Construction of figures. Proof of formulæ used in plane sailing, viz., connecting nautical distance, difference of latitude, departure and course. Examples.

Traverse Sailing.—Definition of a traverse. To resolve a traverse. Construction of traverse table. Examples.

Middle Latitude Sailing.—To prove the formulæ used. Examples.

Second Stage or Advanced Course.

Mercator's Projection and Chart.—Description. How meridians are laid down, and divided for representation of the latitudes. Chief value of the chart is :—"That the angle which a straight line joining any two "places on a chart makes with the meridians is equal to that which the "rhumb line joining the same two places on the globe makes with the "meridians": proof of this.

To draw a Mercator's chart. To find the latitude and longitude of any place on the chart, and *vice versâ*, from the latitude and longitude to find its place on the chart. To find the course between two places on the chart. To find the ship's place by the bearing of two known places or headlands. To lay down a rock, island, or headland from observed bearings. To find the distance between two places on the chart. From the course and distance run to find the place on the chart.

Proofs of rules used in Mercator's sailing. Examples.

Local Deviation.—More accurate account of the causes of sub-permanent and induced magnetism. Laws of induced magnetism in a ship. Semicircular and quadrantal deviation. Description of modes for ascertaining the amount of deviation.

Great Circle Sailing.—Given the latitude and longitude of two places to find the distance between them on a great circle. To find also the latitude and longitude of the vertex. To find a succession of points on a great circle between two places. Examples.

Errors to which the log is liable. Having given the apparent distance run with given known errors in log line and glass, to find the true distance.

To find the difference of longitude made on a traverse. Sea journal. Taking a departure. Log-board and log-book. Day's work. Examples.

Examination for Honours.

In addition to the above there will be required—

The proof of the rule for finding meridional parts, viz.:—

$$m = 3\cdot8988495 + \log.\ (\log.\ \cot.\ \tfrac{1}{2}\ \text{colat.} - 10).$$

Problems in Marine Surveying, &c.

Candidates for examination in this subject are recommended to use the following books:—

A Treatise on Navigation and Nautical Astronomy, by J. Riddle (*with Tables*), 2 vols., 11*s.* 6*d.* Tables separate, 5*s.*
(London, Simpkin & Marshall, 8th ed., 1864.)

Navigation and Nautical Astronomy, by H. W. Jeans, in two parts, 12mo., 5*s.* each, or in one vol. 9*s.*
(London, Longman, new ed., 1860.)

Or, *Navigation and Nautical Astronomy*, by Merrifield & Evers.
(London, Longman & Co.)

Nautical Tables from British Seamen, by James Inman, 8vo., 14*s.*
(London, Rivington, 1862.)

SUBJECT XXI.—NAUTICAL ASTRONOMY.

First Stage or Elementary Course.

Definition.—Circles of declination or hour circles. Equinoctial points. Ecliptic, obliquity of ecliptic, signs of the zodiac. Precession of the equinoxes, circles of celestial latitude. Latitude and longitude of a celestial body.

Declination, right ascension, right ascension of the meridian, sensible and rational horizon. Zenith, nadir, vertical or azimuth circles or circles of altitude. Altitude, azimuth, and amplitude of a heavenly body. Parallels of altitude. Six o'clock hour circle. Prime vertical. Colatitude.

Proof that the altitude of the elevated pole is equal to the latitude of the observer. Illustration by diagrams; projections on the meridian and horizon.

Time. Apparent noon, apparent solar day, mean solar day, mean noon, equation of time. Sidereal day. To convert intervals of mean time into sidereal time, and *vice versâ*. Illustration of these definitions by diagrams. Difference between civil and astronomical reckoning of time. To convert arc into time, and time into arc.

To find the Greenwich date, the time at any other place and longitude being given. To take out the right ascension of the mean sun for a given mean Greenwich date.

The corrections of altitudes:—

1. *Dip.*—Proof that dip in minutes $= \cdot 9784\sqrt{h}$, h being reckoned in feet.
2. *Refraction.*—Why necessary? Show generally how it is measured. Refraction $= 57''$ tan ZD nearly.
3. Correction for semi-diameters.
4. *Parallax.*—Horizontal parallax $\times$ cos. apparent altitude $=$ parallax in altitude.

Sextant.—Description. Adjustments, how to make them. Index error, how it may be found.

Chronometer.—Error and rate. Reading of the chronometer.

Equation of time.—How it is to be applied to the mean time to obtain the apparent time, and conversely.

To find the latitude by a meridian altitude of the sun: proof of the rule and examples. To find the latitude by a meridian altitude of a star.

By the moon:—

1. To find the mean time, and Greenwich date, of the moon's meridian passage on a given astronomical day in a given altitude.
2. To find the semidiameter and horizontal parallax of the moon for a given Greenwich date (mean time) from the Nautical Almanac.
3. To take out the moon's declination from the Nautical Almanac.
4. To find the altitude by the meridian altitude of the moon. Examples.

To find the mean time at any place and also the Greenwich mean time of the passage of a star over a given meridian on a given day, and the distance at which it passes north or south of the zenith. To find the latitude by the altitude, (1), of the sun; (2), of a star; (3), of the moon below the pole. To find the latitude by the altitude of the pole star. To find the variation or local deviation by the observed azimuth or amplitude of the sun. Proof of the rules for finding the azimuth and amplitude. Applications of the rules to find the variation or deviation.

To find the hour angle of a heavenly body east or west of the meridian. To compute the mean or apparent time at any place from the observed altitude of a heavenly body. To find the error and rate of the chronometer. To find the longitude by the chronometer.

Second Stage or Advanced Course.

For the advanced course, in addition to the above, the candidate will be required:—

To compute the reduction of the horizontal parallax.

To define the angle of the vertical, and to describe the method of computing it.

To compute the augmentation of the moon's semi-diameter.

To prove the following rules:—

1. For the reduction of the altitude of any celestial body observed at one place to what it would have been if observed at the same instant at another place.
2. For finding the latitude by the altitude of the pole star.
3. For finding the latitude by altitudes of any celestial body near the meridian.
4. For finding the hour angle of a celestial body from the observed altitude.
5. For finding the rising and setting of celestial bodies and twilight.
6. The error of hour angle for small errors in observed altitude, when least.
7. For finding the latitude and longitude by means of two altitudes.
8. For computing the altitude of a given celestial body for a given time.
9. The method of clearing a lunar distance from the effects of parallax and refraction.

And to work practical examples of all these rules.

To compute the latitude and longitude by double altitudes—1. By Ivory's method. 2. By the direct method.

To find the error of the chronometer by equal altitudes of the sun or of a fixed star. To compute the apparent altitude from the true altitude. To compute the longitude by an observed lunar distance. To describe Summer's method for finding latitude and longitude. Cyclones and tides.

Examination for Honours.

In addition to the above:—

Method of computing the moon's right ascension from an occultation of a fixed star. Longitude by eclipses of Jupiter's satellites. To find

the position of an unknown star or comet by its distances from two known stars. Astronomical problems.

For studying this subject the same books are recommended as have already been given at the end of the courses on *Navigation*.

SUBJECT XXII.—STEAM.

First Stage or Elementary Course.

In the first paper the questions will be restricted to those portions of the syllabus comprised under the heads numbered 1, 2, and 3, or 1, 2, and 4 respectively, and the students will be expected to possess a fair elementary knowledge of the subject.

Second Stage or Advanced Course.

In the second or advanced paper the questions will bear upon those portions of the syllabus numbered 1, 2, 3, and 5, or 1, 2, 4, and 5 respectively, and a more exact knowledge of details will be expected.

Examination for Honours.

The range of subjects will be the same as in the advanced course, but the questions will extend over that portion comprised under the sixth head of the syllabus.

1. *Introductory Matter*.—The expansion of bodies by heat, the liquid and gaseous states of matter, the co-efficient of expansion, energy of the atomic forces, practical illustrations of the expansion and contraction of various substances; the temperature of bodies, instruments for measuring temperature, the thermometer, comparison of thermometers when differently graduated, pyrometers; the capacity of bodies for heat, the calorimeter; the conversion of work into heat and of heat into work, the consumption of heat in liquefaction and vaporization; the convection of heat, the method in which a large mass of water may become heated; the conduction of heat, good and bad conductors, experimental illustrations; the formation of vapour and steam, the boiling points of fresh and salt water, the causes which influence the boiling temperature of water, high-pressure steam, measure of steam pressure by atmospheres, steam when in contact or not in contact with water, the relation between the pressure, density and temperature of steam, the specific gravity of steam, the latent heat of steam, the quantity of water required to produce condensation, common and superheated steam, the analysis of sea water.

   The radiation of heat, the absorption of heat, the general relation between radiation and absorption, good and bad radiators of heat, experimental illustrations.

   The oxidation of metals, the effects of galvanic action.

2. *Steam Engine.*—Newcomen's atmospheric pumping engine, its defects; the discoveries of Watt, the separate condenser, the expansive working of steam, its economy, its value in regulating the power of an engine.

Details connected with Watt's single-acting pumping engine; the steam cylinder, the valves connected with it, their action, the condenser, the air-pump, the foot valve, the delivery valve, the snifting valve, the hot well, the piston rod, stuffing boxes and glands, the parallel motion; the method of starting the engine, and of regulating its speed, the cataract.

The double-acting condensing beam engine, the principle upon which it works; details of the various parts, the cylinder, how constructed, the ports or openings into the cylinder, the forms of slide valve in common use, the locomotive or three-ported valve, the lap on a valve, the eccentric, the lead of a valve, cushioning the steam, clearance, details of the piston, metallic packing-rings; the expansion valve, and the gear connected with it; the air-pump, condenser, the supply of water for condensation, blowing through, gauges for the condenser, the barometer gauge, method of estimating pressure by it, errors in this method, and correction of the same; the connecting rod, the strap gib and cutter, the parallel motion, the governor, the fly-wheel.

The principle of an equilibrium valve, the double beat valve, the crown valve, the throttle valve, the gridiron valve.

The high-pressure engine without condensation, the expansive principle as applied in the double cylinder condensing engine.

The forms of boiler in common use: the Cornish boiler, the cylindrical boiler with internal flues, the vertical boiler, heating and fire-grate surfaces, the evaporative power of boilers, boiler chimneys; the strength of boilers, the use of stays, the proving of boilers. Boiler appendages; safety valves, reverse or atmospheric valves, communication or stop valves, the glass water gauge, steam pressure gauge, various forms, Bourdon's gauge, feed pumps.

3. *The Locomotive Engine.*—The general construction of a locomotive engine and boiler before the invention of Stephenson, the Killingworth engine; description of the Rocket engine by R. Stephenson as the type of the modern locomotive, the tubular boiler, the draught produced by the discharge of waste steam.

The arrangement of an engine, the cylinders, their position, steamways, ports, slide valve, water cocks, grease cocks, the piston and packing-rings, piston-rod, guides, connecting rod, eccentrics, the reversing or link motion, reversing lever, sector, expansive working, crank axle and driving wheels, power required for traction, adhesion of the driving wheels, counter weights to cranks, wheels and axles, axle-boxes, bearing springs, buffer and draw springs, friction brakes.

Details of the boiler; the fire-box, the inner and outer shell, ribs on the crown of the fire-box, the cylindrical barrel, the tubes, mode of fixing them, through tie rods, the ashpit, the smoke box, the blast pipe, mechanical action of the blast, the steam chest, the outer dome, the steam pipe, the regulator, safety valves, pressure gauges, whistles, blow-off cocks, feed pumps, Giffard's injector; evaporative power of the boiler, fire-grate and heating surface, combustion of fuel; the tender, water-tank, brake, feed pipes.

The permanent way; varieties of rails in common use, timber sleepers, transverse and longitudinal systems; jointing of rails, the fish joint; the tyres of wheels, their form, general description of switches and crossings.

4. *The Marine Steam Engine.*—Side lever engine, the oscillating engine for paddle-wheel steamers, the vertical trunk engine; the Gorgon engines, the object of this arrangement; other forms of engine. Engines for screw propellors, direct acting engines with or without

multiplying gear, Penn's trunk engine, Maudslay and Field's return connecting-rod engine.

Details of parts connected with the working of a marine engine; the air pump bucket and valves, double-acting air pump, India-rubber disc valves, cylinder escape valves, bilge and feed pumps, expansion valves, expansion cams and gear. The method of reversing an engine when fitted with a single eccentric, reversing by a double eccentric, the link motion. Paddle wheels, feathering of the floats, disconnexion and immersion of wheels. The screw propeller, various forms, length, angle, pitch, and area of screw blade, disconnecting and raising the screw, the position of the screw propeller in the vessel, the slip of the screw, the method of receiving the thrust upon the vessel, soft metal bearings.

The marine tubular boiler, how constructed, gun-boat boilers, the steam-chest, fire-bridge and ashpit, the funnel and its casing, waste-steam pipe, water gauge, gauge cocks, pressure gauges, safety valves, reverse valves, stop valves, feed pumps, boiler hand-pumps, feed or donkey-engine, Kington's valves, blow-out cocks, brine-pumps and brine-valves, the methods of ascertaining the degree of saltness of the water in a boiler, amount of saltness permissible, formation of scale, superheating apparatus, surface condensation.

Practical working; getting up the steam, filling the boilers, laying the fires, attention to various parts of the engine while the steam is getting up, mode of starting, working the engines at moorings. Priming; its causes and remedies. Duties to machinery when under steam, boilers, fires, &c. Injection pipes. Kingston's valves. Leaks in engines. Bearings of engines. Expansive working. Management of fuel. Damages and repairs to boiler, &c., after accidents. Duties to engine, &c., on arriving in harbour.

5. *Calculations.*—Methods of measuring the efficiency of steam engines. The duty of an engine. The horse power. Mercantile or nominal horse power.

The indicator; the ends it fulfils, description of the instrument, the atmospheric line. Method of taking a diagram. The general configuration of diagram to be expected under various circumstances. Examination of the indicator-diagram when the steam is throttled; when expansive gear alone used, and in other cases. To ascertain the horse-power of an engine by means of the indicator. The indicator-diagram in a high pressure or locomotive engine.

The principle of the parallel motion of a beam engine.

6. *Calculations.*—Estimation of the work done in one stroke of the piston, the same taking clearance into account. To find the horse power from the evaporation in the boiler. De Pambour's theory. Velocity of maximum useful effect. To find the evaporation of a condensing engine of given dimensions and horse power, the piston moving with a given velocity with and without expansion. To find the pressure in the cylinder, knowing the effective evaporation. To find the diameter of a cylinder to work at a certain speed, knowing the evaporation. To find the evaporation in the boiler, knowing the diameter and velocity of the piston and the pressure of steam in the cylinder with and without expansion. The same for locomotive, Watt's engines, &c.

The screw—to find its area, to find also the angle of the helix or thread of the screw propeller, and the pitch. The power exerted by a screw. How far the slip depends on the form and dimensions of the screw. Motion of the paddle-wheels, &c. Consumption of fuel. Measure of the locomotive performance of marine steam engines. To find the angle the crank has moved through when the piston is

at a given distance from the top of the stroke. Amount of work developed by the crank in a half-revolution. Length of the radius-bar in a side lever engine. Work done in the up and down stroke of the air pump. The best temperature for the condenser of a steam engine. Qualities of fuel, &c.

Diagram showing the relative motions of the slide and piston at every point of the stroke.

Dynamometer: to find horse-power of engine by means of it.

The text books specially recommended are—

Treatise on the Marine Steam Engine, by T. J. Main and T. Brown, 8vo., 12*s*. 6*d*. (London, Longman, 5th ed., 1865.)

On the Indicator and Dynamometer, by T. J. Main and T. Brown, 8vo., 4*s*. 6*d*. (London, Longman, 1857.)

Catechism of the Steam Engine, by J. Bourne, 12mo., 6*s*. (London, Longman, 1868.)

And for reference—

Railway Locomotives, by D. K. Clark, 2 vols., folio, 70*s*. (Edinburgh, Blackie, 1856–60.)

Treatise on the Steam Engine, by J. Bourne, 4to., 42*s*. (London, Longman, 5th ed., 1861.)

Examples of Modern Steam, Air, and Gas Engines, by J. Bourne, Part I., 4to., 2*s*. 6*d*. (London, Longman, 1868.)

SUBJECT XXIII.—PHYSICAL GEOGRAPHY.

First Stage or Elementary Course.

For this stage or course it will be expected that the student shall understand and be able to express the simple facts of the science and explain the terms in common use. The following outline may be useful to the teacher as well as to the student:—

1. The form and motions of the earth. Its division into land and water. Size and shape of continents. Low lands, their position and the names by which they are known. High lands or plateaux. Hills. Mountains and mountain systems. Valleys.
2. The ocean and its extent. The names given to different parts. Its depth where known. Its saltness. The movements of the ocean. Marine currents. Waves.
3. Rivers and river systems. Lakes.
4. The air, its nature, extent, and principal uses. Permanent winds. Periodical winds. Storms.
5. Dew. Clouds and rain. Snow and hail. Nature of climate.
6. The nature of earthquakes. The nature of a volcano. Earthquake bands and bands of volcanic action. The simple phenomena of a volcanic eruption.
7. The mode in which plants and animals are distributed on the earth. The mutual relations of horizontal and vertical distribution. The meaning of representative species and the principal groups of plants and animals that represent others in different continents and large islands.
8. The different races of men. The mode in which they are now distributed on the earth.

The examination questions set in this elementary paper will not involve more than a knowledge of such facts as are taught in the ordinary text books.

For a *mere pass* it will only be required that the answers should be so far correct and definite as to show that reasonable care has been taken in explaining the subject, assuming ordinary intelligence and exertion on the part of a young pupil. For a *first class* in this stage sound elementary knowledge and clearness of definition will be indispensable.

Second Stage or Advanced Course.

The more advanced students, who come up in the second stage, will not pass without exhibiting something more than mere elementary knowledge. They must have a knowledge of principles as well as facts. They will be expected to have acquired—

a. So much elementary astronomy as relates to the position of the earth in the solar system, its magnitude and rotation, and the influence of the sun, moon, and other bodies distributed through space on terrestrial phenomena.

b. So much of elementary physics and inorganic chemistry as includes the nature and mode of action of the physical forces and the composition of rocks.

c. So much of elementary geology and mineralogy as includes a knowledge of the nature of rocks, their superposition, succession, and disturbances.

d. So much of palæontology as includes a knowledge of the distribution of life in time.

The bearing of these departments of knowledge on physical geography commonly so called should be understood. The terms used in them must be well appreciated and briefly defined when definitions are asked.

The following outline of the main subjects included in physical geography will show the nature of an advanced course of instruction.

1. Land. Relation of continents and islands. Protuberance of land and preponderance of land in one hemisphere. Form of extremities of land. Grouping of islands. The geographical axes of the two continents. Influence of the form of a coast line. Characteristic features of the various great masses of land.
2. Mountain axes and mountain systems. Details of the great mountain systems of the world, especially with regard to the continents. Relations of the different parts of the great mountain system of Europe and Asia. Isolated mountains and mountain system of Africa. Mountain system of America. Culminating points. Knots in mountain chains.
3. High plains or plateaux; their nature and position. Their relations with the geographical axes and to geographical structure. Examples of plateaux. Plateaux in small islands. Sierras or mountain ridges rising from plateaux. The drainage of plateaux by deep narrow valleys.
4. Low plains; their distribution and relation to high plains and mountains. The low plains of the principal natural divisions of the world. The steppes of Asia. Deserts of Africa and Arabia. Savannahs and prairies of North America. Silvas, Llanos, Pampas of South America. The characteristics of each. Valleys; their varieties and peculiarities. Difference between mountain valleys and the valleys of plateaux.
7. Water; its position on the earth. Natural divisions caused by the protuberance of parts of the earth. Oceans and inland seas.

Depth of the ocean, and means of ascertaining its depth. Nature of the ocean floor. Form of the bottom of the ocean. Solid contents of water. Density of water under different circumstances. Effect of cold on water. Temperature of the sea. Colour of water.

8. Motion of water. Waves. The tidal wave. Currents. The principal stream currents. Drift currents. Irregular movements of water. Sargasso seas.
9. Circulation of water by rivers. Drainage areas and river basins. Nature of water sheds. Origin of rivers. Floods and flood moderators. River systems of the world. Rivers draining into the ocean. Rivers draining into lakes. Groups of lakes; their extent and peculiarities. Waterfalls and rapids.
10. Circulation of water in the interior of the earth. Course of rain water through rock. Issue of this water in springs. Temperature of springs. Mineral and gaseous contents of springs. Quantity of water issuing from springs, and of solid matter deposited by them. Variation of springs.
11. Conveyance of water by clouds, and its deposit as rain. Distribution of rain. Proportion of rainfall that runs over the earth's surface. Formation of snow. Circumstances under which it is formed and deposited. Snow line; its position in different parts of the world. Passage of snow into ice. Glaciers; their ancient and modern history. Glacial action; its nature and results. Icebergs—how and where formed; their influence. Hail; its formation and effects.
12. The atmosphere. Composition and properties of air. Its uses and effects on light. Its extent. Its colour. Effect of heat on the atmosphere. Waves of sound. Nature of wind. Permanent winds. Periodical winds. Circulation of the air by upper currents from the equator to the poles, and corresponding return currents from the poles to the equator. Distribution of winds in both hemispheres. Special local winds and their cause. Various kinds of storm winds. Nature of cyclonic storms. Phenomena connected with such storms.
13. Phenomena of weather and climate. Causes that produce or modify climate. Lines connecting places having equal annual, equal summer, or equal winter heat. Value of such lines as indicating climate. Conditions that affect weather and climate. Cycles of weather and climate. Changes of climate, and the cause of such changes.
14. Volcanic phenomena. General action of volcanoes. The conditions of a volcanic eruption. The parts of the world that contain volcanoes. Number of volcanoes in the different groups; their position and history of the eruptions. Inactive or extinct volcanoes. Pseudo-volcanoes and phenomena connected with decaying volcanic activity. Geysers, solfataras, and mud volcanoes. Volcanic action under the sea. Periods and cycles of volcanic disturbance. Earthquakes. Zones of earthquake disturbance. Relation of earthquakes to volcanoes. Periodicity of earthquakes.
15. Distribution of life on the earth. Persistence of life. Origin of species. Modification of species. Grouping of plants. Representative and typical species. Advance of certain forms of plant life. Migration and migratory powers of plants. Floras of different countries. Distribution of floras. Faunas, their distribution. Groups of characteristic animals. Migration and migratory instincts. Limitation of these instincts. Distribution of plants and animals in time. Extinction and replacement of species.

16. Distribution of man. Date of introduction of the human family. Early existence of certain typical groups. Mode in which these groups differ anatomically among each other. Mixed races. Migrating and settled races, and their mutual influence. Natural and artificial limits of extension of the various races. Influence of man on external nature.

Sound knowledge of the main facts and an acquaintance with the mode of action of natural causes to produce results will be expected from the more advanced students.

Examination for Honours.

For this examination it will be expected that the candidates shall not only be familiar with the ordinary facts and inferences, but that they should be able to give a tolerably complete outline in their own language of groups of facts and their mutual bearing, together with explanations of natural phenomena on which the principles of physical geography depend.

Sound knowledge acquired, not only from text books, but from a thoughtful examination of the views of various authors or from a personal study of the facts and phenomena will be expected from those who seek an honour certificate, and very clear and definite information on the subjects attempted will be indispensable.

For elementary instruction in physical geography there are several recognised text books. It unfortunately happens that in some of these the facts are incorrectly stated, and teachers employing them must be careful to make the requisite alterations in their course of teaching.

The following book, which has been recently published, is recommended :—

* *The World we Live in*, by D. T. Ansted.
(London, Allen & Co., 1868.)

Of somewhat older date are :—

Text Book of Physical Geography, by Dr. Page, 12mo., 2*s*.
(Edinburgh, Blackwood, 1863.)

Outlines of Physical Geography, by E. Hughes, 12mo., 3*s*. 6*d*.
(London, Longman, new ed., 1866.)

Elementary Class Book of Physical Geography, by W. Hughes, 12mo., 1*s*.
(London, Philip, 1866.)

The following will be found suggestive to teachers, but are hardly sufficiently complete to be available for students :—

Earth and Man; a Lecture by A. Guyot, *translated* by C. C. Felton, 12mo., 2*s*.
(London, Bentley, 1865.)

Physical Geography for Schools, by M. F. Maury, 12mo., 2*s*. 6*d*.
(London, Longman, 1864.)

There is at present only one general work that comprises the whole subject of physical geography as required for the examination in the advanced course :—

Physical Geography, by D. T. Ansted, 8vo., 12*s*.
(London, Allen, 3rd ed., 1868.)

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* This work contains a glossary of technical terms.

In addition to the following, many other works in special departments of the science will be found useful to the advanced student and to the candidate in honours:—

Physical Geography of the Sea, by M. F. Maury, 8vo., 5*s*.
(London, Low, 12th ed., 1866.)

Man and Nature, by G. P. Marsh, 8vo., 14*s*. (London, Low, 1864.)

Principles of Geology, by Sir C. Lyell, 2 vols. 8vo.
(London, Murray, 1866.)

Principles of Seismology, by R. Mallet, 2 vols. 8vo., 63*s*.
(London, Chapman and Hall, 1862.)

It is most desirable that this subject should be taught and studied with good physical maps at hand. For the elementary course is recommended—

Small Atlas, by Hughes.

For the advanced student:—

Physical School Atlas, by Johnston.

Larger Physical Atlas, by Johnston.

APPENDIX C.

Tables showing the Number of Students in each Science School or Class, and the Subjects taught.

TABLE I.

LIST of SCIENCE SCHOOLS, giving the NUMBER of STUDENTS returned as under INSTRUCTION in MAY 1868 and MAY 1869, and the NUMBER of PRIZES and MEDALS obtained in MAY 1868 and MAY 1869.

Schools marked with an * are Navigation Schools not examined in May 1869.

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.	
					1868.	1869.			1868.	1869.	1868.	1869.
			ENGLAND.									
Abingdon	British School	Harper, Rev. E. T.	Davis, J. G.	Gubb, E. J. Gubb, Mrs.	46	62	16	..	14	1	..	..
Accrington	Mechanics' Institution	Ingram, J.	Ratcliffe, W.	Isherwood, T. Brown, T.	29	39	10	..	18	5	..	..
Alderley Edge	Reading-room and Library	Consterdine, Rev. J.	Wilkins, A.	Dale, J.	18	16	..	2	6	1	..	..
Almondbury	Grammar School	Brigg, J. T.	Dyson, E.	Easther, Rev. A. Jarmain, G	26	25	..	1	2	..	..	..
Alnwick	Mechanics' Institution	Granville, Rev. C.	Robertson, A.	Muxlow, T. McVail, D. C.	28	38	10	..	..	1	..	..
Altrincham and Bowdon.	Literary Institution	Ransome, A.	Davies, S. B.	Monks, P.	..	48	48	..	..	4	..	..
Andover	Grammar School	Clarke, T. P.	Footner, R.	Marriott, J. T.	39	31	..	8	6	..	..	..
Ashby-de-la-Zouch	Mutual Imp. Society	Green, Rev. T. S.	Dalby, J.	Gibson, G. H.	19	27	8	..	8	..	..	..
Ashton-under-Lyne	Mechanics' Institution	Mason, H.	Hay, G.	Jones, T.	29	25	..	4	12	1	..	..
Aston	Christ Ch. M. I. S. Rooms	Lord, Rev. I.	Windsor, J.	Bulpitt, W. T.	..	19	19	..	..	1	..	..
Bacup	Mechanics' Institution	Aitken, J.	Pilling, J.	Shore, T. W. Tomkins, E.	42	35	..	7	27	..	..	1 B.
Bacup	Wesleyan Day Schools	Dawson, J.	Lord, W. H.	Holland, J.	..	10	10	..	..	7	..	..
Balham	Working Men's Institute	Large, Rev. W. I. A.	Loat, J. H.	Jones, T. Pritchard, Z.	..	18	18	..	..	..	..	..
Banbury	British School	Samuelson, B., M.P.	Hewett, G. A.	Beale, J. H. Owen, A.	48	47	..	1	8	..	1 B.	..
"	Mechanics' Institute	Cobb, F. R.	Wilson, A.	French, A.	..	13	13	..	..	1	..	..
Banstead	School-room	Glyn, P. C.	Buckle, Rev. E. V.	Knibbs, H.	..	33	33	..	..	1	..	..
Barnard Castle	Mechanics' Institute	Brown, Rev. F.	Monkhouse, J.	Witter, J. A. Taylor, R.	..	10	10	..	..	..	..	..
Barnsley	Market Street School	Allen, T.	Gration, J.	Brears, W.	18	17	..	1	1	1	..	..

Barnstaple - -	Literary and Scientific Institution.	Miller, J. M. - -	Knill, W. - -	Dunston, J. J. - ; Maunder, S. G. -	..	78	78	..	..	..	..	..
Batley - - -	Mechanics' Institution -	Jubb, J. - - -	Hick, W. H. - -	Osborne, J. - -	..	8	8	..	..	1	..	..
Beccles - - -	Leman Schoolroom - -	Garnham, W. W. -	Whiting, Rev. R. -	Boyce, H. - -	..	27	27	..	..	..	..	..
Bedford - -	St. Mary's Parochial School	Gray, T. T. - -	Kaye, Rev. A. -	Glover, A. W. - -	..	21	21	..	..	3	..	..
Bingley - -	Mechanics' Institution -	Irwine, Rev. A. P. -	Todd, T. - -	Severs, G. - -	17	19	2	..	3	1	..	..
Birkenhead - -	School of Art - -	Taylor, J. - -	Hinde, W. E. - -	Bentley, J. - -	..	30	30	..	..	3	..	..
Birmingham -	B. and Midland Institute -	Mathews, W., jun. -	Smith, E. - -	Woodward, C. J. - ; Bulpitt, W. T. - ; Hinds, W. - ; Hinds, J. -	152	230	78	..	49	22	1 B.	..
„ - -	School of Art - - -	Cope, C. R. - -	Laundy, E. - -	Raimbach, D. W. ; Causer, W. G. -	75	77	2	..	33	13	1 B.	..
„ - -	Clarendon Chambers -	Manton, H. - -	Southall, A. - -	Smith, D. - - ; Turner, J. - - ; Davis, J. - - ; Smith, A. F.	11	30	19	..	8	4	..	..
„ - -	Bloomsbury Institution -	Milward, Rev. H. C.	Atkins, J. - -	Smith, D. - - ; Smith, A. F. - - ; Bulpitt, W. T. - ; Griffin, J. R. - ; Walton, W. -	80	104	24	..	26	8	..	..
„ - -	Graham Street Institution -	Vince, Rev. C. - -	Jennings, J. W. -	Smith, D. - - ; Walton, W. - -	..	24	24	..	..	2	..	..
„ - -	Church of the Sav. School -	Myers, Rev. E. -	Hemming, W. H. -	Embrey, G., junr. -	..	20	20	..	..	..	..	..
„ - -	St. George's School - -	Thornton, Rev. S. -	Smith, G. - - -	Bulpitt, W. T. -	..	58	58	..	..	6	..	1 S.
„ - -	St. Paul's School - -	Burges, Rev. R. B. -	Langford, J. A. -	Embrey, G., junr. -	..	66	66	..	..	..	..	..
„ - -	12, Ann Street - -	Manton, H. - -	Hart, J. - - -	Burton, C. - -	..	14	14	..	..	..	..	..
„ - -	St. Mary's School - -	Barrett, Rev. J. C. -	Jones, J. - - -	Bulpitt, W. T. -	..	16	16	..	..	..	..	..
„ - -	St. Mark's School - -	Thwaites, Rev. H. G.	White, W. - -	Buckley, H. C. -	..	59	59	..	..	..	..	..
„ - -	St. Clement's School -	Milward, Rev. H. C.	Hawkes, B. - -	„ -	..	20	20	..	..	5	..	..
„ - -	Deritend W. Men's Assoc. -	Solomon, H. - -	Greening, W. H. -	Bulpitt, W. T. -	..	23	23	..	..	..	..	..
„ - -	New Jerusalem Schools -	Tonks, S. - -	Osborne, J. - -	Jones, G. F. - -	..	7	7	..	..	..	..	..
„ - -	Middle Class School - -	Rolason, W. - -	Payton, H. - -	Causer, W. G. - ; Hall, S. - -	..	19	19	..	..	2	..	..
„ - -	Bishop Ryder's School -	Yorke, Rev. G. M. -	Burges, Rev. J. H. -	Paterson, C. - - ; Thorneloe, J. -	..	40	40	..	..	..	..	..
Birstall - - -	Mechanics' Institution -	Heald, Rev. W. M. -	Priestley, J. W. -	Patchett, I. - -	26	53	27	..	22	2	..	..
Blackburn - -	Wesleyan School - -	Beads, J. - - -	Parkinson, G. - -	Isherwood, T. - ; Spriggs, C. - -	9	35	26	..	4	8	..	..
„ - -	Church Institute - -	Woodhouse, Rev. C.	Elwell, Rev. H. -	Sayle, J. - - -	..	6	6	..	..	..	..	..
Blackley - -	Assembly Room - -	Langton, W. - -	Schofield, J. - -	Hurst, W. - -	..	31	31	..	..	2	..	..
Blyth - - -	Waterloo School - -	Greenwell, Rev. W.	Rees, W. - - -	Rowden, W. T. -	..	46	46	..	..	6	..	..
Bodmin - -	Literary Institution - -	Stokes, H. S. - -	Phillipps, J. - -	Downing, S. - -	31	69	38	..	16	1	..	..
Bolton - - -	Science and Art School -	Powell, Rev. Canon	Doman, Rev. J. G. -	Collins, J. - - ; Spriggs, C. - -	193	161	..	32	37	5	..	..

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.	
					1868.	1869.			1868.	1869.	1868.	1869.
Bolton	Mechanics' Institution	Harwood, R.	Barrow, I.	Spriggs, C.	67	64	..	3	16	4	1 B.	..
Boston	National School	Blenkin, Rev. G. B.	Lowe, Rev. G.	Gane, W.	..	25	25	..	..	..	..	..
"	School of Art	" "	"	Howard, V.	..	18	18	..	..	4	..	..
Bow, North	Old Ford School-room	Schnadhorst, Rev. E.	Smith, E.	Duff, C. Saunders, J.	..	20	20	..	..	6	..	..
Bradford	Mechanics' Institute	Law, J.	Holbrey, J.	Severs, G.	..	10	10	..	..	3	..	..
Breage	Wheal Vor, Sithney, and Cross.	Pridmore, Rev E.	Argall, W.	Collins, J. H. Kitto, B. Henty, G. M. Tyack, W. Francis, H.	23	52	29	..	17	2	2 B.	..
Brighouse	Mechanics' Institute	Ormerod, J. T.	Ormerod, Thomas	Jarmain, G.	..	11	11	..	..	..	..	..
Brigstock	Farming Woods School	Attenborough, J.	Bradshaw, W. P.	Garner, S. Dumas, J.	..	53	53	..	..	2	..	..
Bristol	Trade School	Moseley, Rev. Canon	Wilkson, J.	Coombor, T. Plant, E. C. Welsh, J. Morgan, W.	145	200	55	..	106	94	1 G. 1 B.	1 G. 1 S. 2 B.
"	Young Men's Chr. Assoc.	Cornall, Rev. R.	Pengelly, T. H.	Ewens, F. T.	..	17	17	..	..	4	..	..
Brixworth	Boys' School-room	Watkins, Rev. C. F.	Harper, F. L.	Graves, J. J.	..	30	30	..	..	2	..	..
Bromsgrove	Literary and Mechanics' Institution.	Murray, Rev. G. W.	Gibson, C. W.	Dodd, W.	26	66	40	..	7	..	..	..
Buckingham	National School	Morris, Rev. W. F.	Waters, H.	Heel, E.	..	11	11	..	..	..	..	..
Burnley	Literary Institution	Parker, Rev. A. T.	Briggs, B. W.	Shore, T. W.	58	47	..	11	14	5	..	..
"	Carlton Road School	Ashworth, D.	Graham, J.	Grant, J.	61	59	..	2	6	..	..	..
"	Mechanics' Institution	Kay - Shuttleworth, Sir J. P., Bart.	Sutherland, J.	Shore, T. W. Thompson, J.	48	77	29	..	12	4	..	..
"	Grammar School	" "	"	Shore, T. W. Wilkinson, T. T.	40	40	..	..				
Bury	Athenæum	Hildyard, Rev. C. F.	Probert, T. W.	Spriggs, C.	79	77	..	2	25	10	..	..
Caistor	Lower Grammar School	Maclean, Rev. H.	De Mowbray, Rev. J.	Thomas, R.	..	13	13	..	..	..	..	..
Camborne	Basset Street	Chappel, Rev. W. P.	Reynolds, J. P.	Provis, T. B.	24	12	..	12	5	..	..	..
Canning Town	Holy Trinity School	Meyrick, Rev. M.	Peacock, W. H.	Shipman, O. Downar, W. A.	12	34	22	..	5	6	..	..

Cardiff	Free Library	Tomlinson, J., jun.	Price, P.	Bush, J. Thomas, G.	63	91	28	..	27	10	..	..
Carharrack	Literary Institution	Tucker, E. B.	Hawke, E. H.	Collins, J. H.	..	20	20	..	..	..	..	..
Chatham	St. Mary's School	Hills, V.	Wilkins, T.	Byatt, H. Farlie, J. L.	40	57	17	..	26	6	..	..
"	St. Mark's, New Brompton	Neville, H. J. W.	Bridger, J.	Byatt, H. Stanton, G.	27	37	10	..	19	10	..	1 G.
Cheltenham	School of Science, Clarence Parade.	Skillicorne, W. N.	Moore, H. J.	Ewens, P. T. James, H. A. Litting, G.	212	64	..	148	32	5	1 G.	..
"	Training College	Skillicorne, W. N.	Moore, H. J.	James, H.								
"	Whitworth School	Lumb, B. K.	Dixon, R. J.	Davis, W. S. Sergeant, L. Davis, T. H.	..	266	266	..	..	14	..	1 B.
Chester	Mechanics' Institution	Frost, M.	Deacle, Rev. E. L.	Craister, W.	30	45	15	..	8	5	..	..
Chorley	St. George's National School	Barton, R. H.	Stock, J.	Brown, T.	20	15	..	5	7	6	..	..
Church	National School	Birchall, Rev. J.	McKenzie, T. S.	Sutcliffe, G.	..	57	57	..	..	2	..	..
Coalbrookdale	School of Art	Dickinson, H.	Squire, E. L.	Woolner, H.	..	25	25	..	..	..	..	..
Colne	Grammar School	England, T. T.	Philips, T.	Brown, T.	..	30	30	..	..	4	..	..
Compstall	Athenæum	Andrew, C.	Fernley, J.	Hurst, W.	27	26	..	1	20	8	..	..
Coventry	St. Peter's National School	Odell, J.	Tabberer, Rev. G.	Bates, J.	..	30	30	..	..	..	..	..
Cradley	School-room	Thompson, Rev. J. H.	Gregg, Rev. T. H.	Hodgetts, C. B.	6	12	6	..	2	..	..	..
Creaton, Great	National School	Wood, J.	Crow, Rev. E.	Meredith, J.	..	10	10	..	..	..	..	..
Crewe	Mechanics' Institution	Ramsbottom, J.	Jackson, J. A.	Craister, W.	44	31	..	13	20	9	..	..
Croydon	Literary Institution	Carpenter, A.	Lanchester, H. T.	Jones, T. Duckett, W.	32	17	..	15	13	..	..	..
Culham	Training College	Pott, Rev. A.	Causton, Rev. F. J.	Ridgway, Rev. J. Herbert, Rev. A.	27	23	..	4	3	5	..	..
Darlington	Mechanics' Institution	Pease, H.	Watson, T. W.	Heys, A. Weatherill, R.	13	19	6	..	6	..	..	..
Dartford	National School	Bowlby, Rev. H. B.	Perry, A.	Busbridge, W. Dance, W.	36	27	..	9	27	2	..	..
Dartmouth	Mutual Imp. Society	Newman, A.	Rees, W. H.	Hamlyn, E.	26	39	13	..	6	..	..	..
Darwen	Mechanics' Institution	Blamire, Rev. W. H.	Neville, E.	Isherwood, T.	14	9	..	5	3	..	..	..
Daventry	Grammar School	Collyns, Rev. J. M.	Marriott, T. H.	Rigby, J.	..	16	16	..	..	1	..	..
Denton and Haughton	Mechanics' Institution	Nicol, Rev. W.	Collins, John	Gee, W. Booth, I.	33	20	..	13	12	1	..	..
Deptford	St. Paul's Boys' School	Malcolmson, Rev. J.	Marchant, T. W.	Busbridge, W. Hopper, T. Ellercamp, H.	21	85	64	..	27	17	..	..
"	Mechanics' Institution	Avery, C.	Noak, W.	Jones, T. Theaker, G. Child, T.	..	18	18	..	..	3	..	..
Derby	Grammar School	Forman, T. B.	Bowring, C.	Greaves, C. A.	12	10	..	2	..	..	..	..
Devonport	Mechanics' Institution	Peek, W.	Chapple, S.	Balkwill, F. P.	..	8	8	..	..	..	..	..

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	Number of Individuals under Instruction. 1869.	Increase.	Decrease.	Number of Prizes. 1868.	Number of Prizes. 1869.	Number of Medals. 1868.	Number of Medals. 1869.
Dewsbury	Mechanics' Institution	Day, E.	Warburton, J.	Shaw, J.	17	17	..	..	1	1	..	..
Doncaster	The Guildhall	Vaughan, Rev. C. J.	Bishop, T. H.	Constable, J.	..	24	24	..	..	2	..	..
Droylsden	Educational Institution	Hadwen, J.	Hadfield, J.	Hurst, W. Riley, J. Baguley, M.	58	49	..	9	28	13	..	..
Dudley	Mechanics' Institution	Harper, R.	Hollier, E.	Green, F. Williams, J. Causer, W. G.	..	69	69	..	..	1	..	..
"	Blue Coat School	Wainwright, H.	Brettell, T.	Williams, J.	..	50	50	..	..	..	..	..
Dukinfield	Old Chapel Sunday School	Marshall, W.	Cartwright, J.	Jones, T.	..	31	31	..	..	..	..	..
"	Moravian Boys' School	Sutcliffe, Rev. C. E.	Knott, C. J.	Jones, T.	..	15	15	..	..	..	..	..
Durham	Training College	Henderson, W.	Earle, W. E.	Ashwell, Rev. A. R. Powley, W. Howard, C. C.	29	18	..	11	14	..	..	..
Eagley	Institute	Greg, A.	Marson, G.	Pinnington, W.	31	20	..	11	5	..	..	..
Earlestown	Mutual Improvement Society.	Whitley, Rev. J.	Shaw, C.	Stott, H., senr. Burchall, C.	17	24	7	..	5	10	..	..
Earls Barton	British School	Gaudern, J.	Sheffield, D.	Webb, J.	..	52	52	..	..	..	..	..
Eastington	National School	Peters, Rev. T.	Hooper, C. H.	Wilcox, E. Wilcox, E., junr.	15	16	1	..	3	2	..	..
Eastwood	Mechanics' Institution	Plumptre, Rev. H.	Weston, W.	Fisher, H.	13	9	..	4	6	..	..	..
Elland	Science School, Southgate	Farrar, J.	Kaye, U.	Jarmain, G. Stopford, W. H.	22	43	21	..	11	8	..	1 S.
Eston	Parochial Institution	Jackson, Rev. W. W.	Moyle, Rev. V. H.	Moir, D.	..	13	13	..	..	..	..	..
Exeter	Albert Memorial Museum	Head, R. T.	Tucker, J. T.	D'Urban, W. S. M. Perkins, F. P. Sheppard, W.	32	34	2	..	11	4	..	..
Failsworth	Mechanics' Institution	Wright, R.	Brierley, J.	Stott, H., senr. Stott, H., junr.	8	20	12	..	1	10	..	..
Farnworth	Grammar School	Taylor, Rev. W. H.	Bowden, T.	Spriggs, C.	..	32	33	..	..	3	..	..
Farnworth and Kersley.	Mechanics' Institution	Barnes, A.	Thornley, P.	Monks, P.	..	20	20	..	..	2	..	..
Flore	Endowed School House	Johnson, Rev. F. P.	Poole, D.	Rigby, J.	..	34	34	..	..	..	..	..
Friezland	Christ Church School	Whitehead, J. H.	Venables, Rev. G.	Kershaw, J.	..	11	11	..	..	..	..	..

Frome	School of Art	Horner, Rev. J. S.	Singer, J. W.	Goepel, J. E.	..	40	40	..	..	..	..	..
Gateshead	National School	Prest, Ven. E.	Arnold, Rev. R. S.	Wheatley, M. J. Russell, Rev. C. D. Brodie, A.	30	101	62	..	13	7	..	..
Glossop	Working Men's Institute	Stafford, J.	Bradbury, E.	Jones, T.	..	42	42	..	..	6	..	..
Gloucester	Blue-coat School	Washbourn, B.	Fowler, Rev. H.	Jeffery, Walter	44	33	..	11	38		..	..
"	10, Eastgate Street	"	"	Davis, W. S.	34	19	..	15		5	..	..
Gomersal	Mechanics' Institution	Crowther, W.	Kellett, J.	Patchett, I.	..	19	19	..	..	..	..	..
Grantham	National School	Astlee, W.	Maddison, Rev. G.	Cockman, A.	..	12	12	..	..	3	..	1 G.
Greenwich	Girls' National School	Miller, Rev. J. C.	Howarth, W.	Wright, H. E. Gough, W. G.	20	27	7	..	11	3	..	..
Halifax	Working Men's College	Akroyd, E., M.P.	Gibb, G.	Jarmain, G. Stopford, W. H.	35	52	17	..	7	1	1 G. 1 B.	1 B.
Halliwell	Dean Mills	Callender, W. R., jun.	Taylor, W.	Spriggs, C.	..	20	20	..	..	1	..	..
Hampton	Commercial School	Burrow, Rev. J.	Raw, D. R.	Bickerton, A. W.	..	30	30	..	..	2	..	..
Haslingden	Institute	Thompson, R.	Binns, J.	Shore, T. W.	18	25	7	..	8	1	..	..
Helston	Grammar School	Penberthy, F.	Hosking, J. H.	Tyacke, W.	..	20	20	..	..	1	..	..
Hetton	Colliery Schools	Wood, L.	Widowfield, F.	Rowden, W. T. Meek, J.	..	88	88	..	..	14	..	..
Heywood	Mechanics' Institution	Storry, Rev. R.	Fairbrother, G.	Crawshaw, J. Duerr, G.	44	18	..	26	8	2	..	..
Hingham	National School	Darby, Rev. M. B.	Hardinge, Rev. J. R.	Wilson, W. E. H.	..	22	22	..	..	..	..	..
Hollinwood	Working Men's Institute	Collinge, J.	Wilde, J.	Haslam, W.	31	12	..	19	9	..	..	..
Holywell Green	Mechanics' Institution	Shaw, S.	Shaw, S. W.	Shaw, J.	..	12	12	..	..	3	..	..
Hopwood	Methodist Free Church School.	Cheetham, C.	Fairbrother, G.	Duerr, G.	..	7	7	..	..	..	..	..
Huddersfield	Mechanics' Institution	Freeman, J.	Bate, J.	Jarmain, G. Kershaw, T.	23	60	37	..	9	13	..	..
Hull	Nautical School	Whitaker, T.	Wilson, E. S.	Seaping, Z.	30	79	..	1	50	7	2 G. 1 S. 1 B.	1 G. 1 S.
Huntingdon	Walden's School	Ward, W.	Vesey, Rev. F. G.	Pascoe, J.	16	16	..	..	3	..	..	..
Hurst	Mechanics' Institution	Rowley, A. B.	Pleasants, J.	Stott, H.	..	12	12	..	..	4	..	..
Hyde	Mechanics' Institute	Hibbert, E.	Lawton, T.	Fallows, J. T. Parnell, G. Taylor, T.	41	50	9	..	17	..	..	..
Kendal	Post Office Yard Room	Whitwell, J., M.P.	Braithwaite, C. L.	Prosser, W.	..	92	92	..	..	2	..	..
Kersley	British School	Fletcher, J.	Gee, S.	Collins, J.	..	14	14	..	..	..	..	..
Kettering	National School	Lindsay, Rev. H.	Eldred, G.	Sturgess, W.	52	53	1	..	25	7	..	..
"	British School-room	Toller, W.	Mursell, Rev. J.	Brooks, W. W.	..	36	36	..	..	1	..	..
Kidderminster	Mutual Improvement Society	Boyle, Rev. G. D.	Fortescue, Rev. H.	Thompson, G.	..	6	6	..	..	..	..	..
Kilburn	St. Mary's School	Kennion, Rev. A.	Willis, W.	Kehde, H.	..	30	30	..	..	6	..	..
Kingsbridge	Town Hall	Davis, Rev. J. U.	Thomas, W. J.	Head, A.	17	19	2	..	..	..	..	..

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.	
					1868.	1869.			1868.	1869.	1868.	1869.
Kinver	Mill Room	Hodgson, Rev. J.	Bolton, W. H.	Packer, M. W.	25	18	..	7	5	..	..	..
Lamport	Endowed School	Isham, C. E.	Isham, R.	Graves, J. J.	..	53	53	..	..	..	..	..
Lancaster	Mechanics' Institution	Howitt, T.	Moore, J. D.	Prosser, W.	48	80	32	..	9	10	..	..
"	School of Art	Coupland, R.	Storey, W.	Gilbert, H.	..	12	12	..	..	4	..	..
Leeds	Mechanics' Institute	Holmes, J.	Dayson, J. O.	Ward, G.; Hick, T.; Todd, W.; Horsman, T.	47	96	49	..	23	23	1 B.	2 S. 1 B.
"	St. Peter's National School	Woodford, Rev. J. R.	Wood, Rev. F. J.	Jefferson, S.	..	27	27	..	..	1	..	..
"	" Schoolmaster's Class	Fairbairn, Sir A.	Sales, H. H.	Jarmain, G.	..	37	37	..	..	5	..	..
"	Young Men's Chr. Ass.	Barran, J.	Smith, W. H.	Jefferson, S.	..	36	36	..	..	1	..	..
"	Working Men's Institute	Lupton, D.	Lupton, D., jun.	"	..	17	17	..	..	1	..	..
Lees	Parish Church School	Booth, J. E.	Whittaker, Rev. R.	Kershaw, T., jun.	33	35	2	..	11	6	..	..
Leicester	St. Martin's School	Vaughan, Rev. D. J.	Jones, H. S.	Atkins, E.	53	100	47	..	16	11	..	1 B.
"	St. Margaret's School	Jones, Rev. T.	Pertwee, Rev. A.	Padmore, S.	5	57	52	..	..	..	..	..
Leighton Buzzard	Mutual Improvement Society	Harris, T.	Page, W. S.	Lewis, E. W.	..	22	22	..	..	..	..	..
Lewes	School of Art	Godlee, B.	De Putron, Rev. P.	Fisher, A.	..	10	10	..	..	..	..	..
Lewisham	St. Mary's National School	Legge, Rev. H.	Sowerby, Rev. W.	Wright, H. B.; Gough, W. G.; Churchill, C.	..	18	18	..	..	3	..	..
Limehouse	St. Anne's National School	Jones, Rev. E. R.	Wiggins, F.	Farncomb, E.	24	20	..	4	2	2	..	..
Lincoln	Training School	Jarvis, G. K.	Blenkin, Rev. F. B.	Meers, Miss J. P.	..	45	45	..	..	1	..	..
Liverpool	Free Library and College	Graves, S. R., M.P.	Gregson, S. L.	Carter, W.	60	130	70	..	18	16	..	..
"	Institute	Holt, P. H.	Sharp, C.	Ewart, E. B.; Adair, S.	107	150	43	..	38	34	..	1 G. 2 B.
Llanelly	Copper Works School	Nevill, C. W.	Morgan, R.	Jones, J.; Jones, A.	73	88	15	..	28	15	..	..
LONDON: Battersea	St. John's College	MacCarthy, Rev. J.	Dugard, F.	Faunthorpe, Rev. J. P.; Roberts, G.	80	80	..	..	98	17	1 G. 1 S.	..
"	Sir Walter St. John's School	Ince, Rev. E. C.	Hardy, T. E.	Martin, J.	53	90	37	..	..	..	..	..
"	Christ Church Schools	Ince, Rev. E. C.	Foster, G. W.	Brown, H.	..	56	56	..	..	1	..	..

	Working Men's Club	Griffiths, Rev. T. C.	Tyrer, T.	Weightman, F. J.	..	16	16	..	..	..	..	..
Bermondsey	Christ Church Schools	Martin, Rev. R. M.	Lugg, J. W. H.	Jones, T.; Child, T.	22	12	..	10	4	4	..	..
"	Working Men's Institute	Cox, W. H.	Fawsitt, R.	Hudson, W.	..	17	17	..	..	..	..	..
Bethnal Green	Birkbeck School	Rogers, Rev. W.	Bünts, G.	Pike, R. W.; Honey, J.	100	182	26	..	38	4	..	..
"	National School	Hansard, Rev. S.	Ewing, Rev. A.	Simpson, B.; Angel, H.; Farncomb, E.	115	144	29	..	13	10	..	..
Brixton Hill	Working Men's Club	Longridge, J. A.	Gibbons, G.	Jones, T.; Bradbury, A. A.	9	20	11	..	8	3	..	..
Chancery Lane	Birkbeck Literary and Scientific Institution	Campbell, Hon. D.	Knott, J. W.	Chaloner, G.; Dyte, D. H.	..	47	47	..	..	1	..	..
Chelsea	St. Mark's College	Batty, Rev. W. E.	Quilter, J. S.	Eastburn, Rev. C. F.; Dawe, Rev. C. S.; Lawson, W.; Harrison, W. T.	48	79	31	..	62	14	..	..
"	Arthur Street	Dilke, Sir C. W., Bart.	Demaus, Rev. R.	Bickerton, A. W.; Davies, S. W.	153	177	21	..	46	27	1 S., 1 B.	1 S., 1 B.
"	Royal Military Asylum	Muller, Col. E. A.	Langmead, Rev. G.	Reynolds, W. J.	11	23	12	..	11	18	..	..
*Dock Street	Sailors' Home	Maude, Capt. Hon. F.	Webb, Capt. W. H.	Newton, J.	328	323	..	6	..	..	..	..
Goswell Road	St. Barnabas' National Sch.	Ward, Rev. H.	Millington, Rev. W.	Conning, J.; Furniss, J. S.	..	27	27	..	..	1	..	..
Gray's Inn Rd.	St. Jude's School	Andrews, Rev. J. M.	Wooldridge, J. W.	Busbridge, W.	..	80	80	..	..	25	..	..
Great Ormond St.	Working Men's College	Maurice, Rev. F. D.	Rawlins, H. E.	Grugeon, A.	15	12	..	3	2	..	..	..
Hackney	St. Thomas' Square School	Daniell, Rev. R. S.	Reynolds, A. W.	Howard, J.; Bond, G.	48	141	93	..	12	4	..	..
Islington, Lower	Public School	Fleming, Rev. W.	Wheatley, H. J.	Howard, J.; Angel, H.	145	185	40	..	38	14	..	..
"	St. Silas' National School	Wilkinson, Rev. J.	Huse, W.	Hepburn, R.; Swanson, W.	..	20	20	..	..	4	..	..
Kennington	St. John's Middle Class Sch.	Reed, F.	Neville, J.	Schenck, R.	..	7	7	..	..	..	..	..
Kentish Town	Gospel Oak School	Lee, Rev. C.	Stanes, H. T.	Bond, G.	..	87	87	..	..	..	..	..
Knightsbridge	Albert Working Men's Club	Dilke, Sir C. W., Bart., M.P.	Demaus, Rev. R.	Bickerton, A. W.; Davies, S. W.	†	†	†	..	†	†	..	..
Lambeth	Boys' School, Hercules Buildings	Lingham, J.	Jones, Walter W.	Jones, T.; Hernaman, J.; Browne, L.; Jones, E. S. L.; Duckett, W.; Brittle, J. R.; Heller, T. E.	135	209	54	..	13	..	1 S., 1 B.	..
"	School of Art	Gregory, Rev. R.	Herbert, Rev. G. W.	Sparkes, J.; Jennings, J.; Schenk, R.	..	36	36	..	..	3	..	..

† Included with Arthur Street, Chelsea.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.
LONDON—*cont.*												
Leadenhall St.	City of London College	Mackenzie, Rev. C.	Hansen, H. W.	Gibsone, Rev. B. W. Hawker, G.	30	46	16	..	..	1	..	..
Long Acre	Whitefield School-room	Scotliff, J. P.	Fraser, A. A.	Duffy, F. P.	..	19	19	..	..	..	..	..
Marylebone	Central Boys' School	Eyre, Rev. C. J. P.	Goody, Rev. C. J.	Jones, T. McCarthy, W. W. Ricks, G.	48	86	38	..	2	1	..	..
"	Quebec Club	Fremantle, Rev. W.	Davison, R. W.	Dorrell, C. F. Dorrell, H. B.	..	28	28	..	..	1	..	..
Nine Elms	Lecture Room	Mather, Rev. W. M.	Sellar, F.	Bickerton, A. W. Davis, S. W.	..	37	37	..	..	6	..	..
Notting Hill	Shaftesbury Hall	Gell, Rev. P.	Winton, W.	Jones, T. Oatley, W. Swanson, W.	..	18	18	..	..	3	..	..
Paddington	Greville House	Merivale, J. L.	Deans, C.	Jones, T. Duckett, W. Bray, G.	31	48	17	..	10	6	..	..
"	St. James' School	Moorhouse, Rev. J.	Evans, R.	Brown, L.	..	35	35	..	..	..	..	..
Peckham	Upper and Middle Schools	Gray, R. A.	Hutchison, T.	Jones, A. Brewer, W. H. Ozer, T. Clarke, G. W.	362	181	..	181	30	..	..	..
Poplar	All Saints' National School	Nowell, Rev. T. W.	Fairbairns, W.	Swim, H. Gass, E. H. J.	..	30	30	..	..	5	..	..
Regent Street	Royal Polytechnic Inst.	Mackenzie, Rev.	Cousens, J.	Downar, G. F. Hardy, J.	46	55	9	..	19	7	1 G. 1 S. 3 B.	..
South London	Working Men's College	Huxley, Prof.	Rossiter, W.	Jones, T. Hands, G. J. Bithell, R.	..	29	29	..	..	..	..	..
Southwark	Borough Rd. Tr. College	Owen, H.	Bourne, S.	Curtis, J. C. Smith, A. F. Barkby, H. Langton, J.	60	150	90	..	20	25	..	..
"	Boys' Model School											
"	Swan Street Boys' Nat. Sch.	Moulton, Rev. D. A.	Baylis, W. J.	Parry, P.	..	24	24	..	..	..	..	..
"	Working Men's Club	Desborough, Rev. H.	Taylor, S. S.	Hudson, W.	..	24	24	..	..	5	..	..

Stepney	Red Coat School	Charrington, F.	Scott, W.	Parry, P.	..	20	20	..	..	1	..	..
Up. Berkeley St.	Hampden Gurney Schools	Holland, Rev. F. J.	Birley, Rev. B. H.	Browne, L.	..	9	9	..	..	..	..	..
Vauxhall	Baptist Chapel School-room	Lawrence, J. C., M.P.	Hearson, Rev. G.	Busbridge, W.; Newman, G.	..	45	45	..	..	5	..	..
"	Wandsworth Road	Shepherd, Rev. C. P.	Grimsdick, C.	Parry, P.	..	10	10	..	..	3	..	..
Wandsworth	Royal Patriotic Fund Boys' School	Lindsay, Maj.-Gen.	Mugford, W. H.	Bickerton, A. W.; White, H.	..	57	57	..	..	..	..	..
Waterloo Road	St. John's Schools	Johnston, Rev. J. A.	Quaif, W.	Busbridge, W.; Norman, H.; Thompson, R.	30	58	58	..	33	26	..	..
Westminster	Wesleyan Training College	Hall, T. F.	Olver, Rev. G. W.	Sugden, W.; Langler, J. R.; Mansford, C.	29	94	65	..	26	25	..	..
"	St. James the Less N. Sch.	Dickson, Rev. G.	Giveen, Rev. R. L.	Busbridge, W.; Whitehouse, H. J.	..	41	41	..	..	11	..	..
Luddenden Foot	Day School-room	Whitworth, W.	Hillman, Rev. S. D.	Tattersall, A.	..	38	38	..	..	1	..	..
Macclesfield	Modern Free School	Wardle, T.	Brooker, J.	Jackson, J.	43	43	..	..	..	..	..	..
Malden	Mechanics' Institution	Horwood, Rev. E. R.	Crick, G. E.	Hollinshed, T. M.; Potter, J. W.	12	15	3	..	9	1	..	..
Manchester	Mechanics' Institution	Neill, R.	Jones, E. L.	Angell, J.; Gee, W.; Mellor, J.; Tomkins, E.	200	240	40	..	64	21	1 G.; 1 S.; 2 B.	3 G.; 1 S.; 3 B.
"	Roby Society's School	Callender, R. W., jun.	Wilkinson, E.	Stott, H., jun.; Almgill, T.	39	12	..	27	9	2	..	..
"	Corporation Street	Booth, G.	Larmuth, G. H.	Lightbown, J. H.	41	49	8	..	13	12	..	..
"	St. George's National School	Lindsay, Rev. T.	Gregory, J.	Kay, W.	12	10	..	2	1	..	..	..
"	Hulme W. M. Inst.	Booth, W.	Letch, G. A.	Richardson, J.; Richardson, H.; Jones, T.	31	38	7	..	12	4	..	..
Masham	Grammar School	Hedley, Rev. T.	Carter, W.	Crawley, S.	..	10	10	..	..	..	..	..
Melton Mowbray	Church School-room	Colles, Rev. W. M.	Willcox, W.	Greasley, J.	3	10	7	..	..	..	..	..
Middlesborough	St. John's Schools	Smith, Rev. A. C.	Blair, Rev. G. A.	Stead, W.	11	8	..	3	8	8	..	..
Middleton	National School	Bates, Rev. E.	Ward, Rev. C. B.	Wheeler, G. H.	22	35	13	..	17	1	1 B.	..
Millwall	Presbyterian School	Whitmore, Rev. C. J.	Auld, J.	Farncomb, E.	..	16	16	..	..	..	..	..
Modbury	The Institution	Green, Rev. G. C.	English, Rev. A. R.	Pady, W. J.	10	33	23	..	1	..	..	..
Monkwearmouth	Colliery School	Stobart, W.	Waller, J. E.	Rowden, W. T.	..	41	41	..	..	..	..	..
Mossley	Mechanics' Institution	Jones, Geo. A.	Jackson, T.	Kershaw, T.	23	23	..	..	2	2	..	..
Murton	Colliery School	Walrond, Rev. F. F.	Archbold, J. W. M.	Rowden, W. T.; Jack, D.	..	53	52	..	..	11	..	..
Nailsworth	National School-room	Stokes, T.	Thomas, Rev. E. T.	Smith, P. L.	..	8	8	..	..	1	..	..
Nelson-in-Marsden	Lomeshaye Schools	Ecroyd, W.	Waddington, J.	Clement, L.	36	35	..	1	23	..	..	..
Newark	Mechanics' Institution	Godfrey, T. S.	Lammin, H.	Webster, J. H.; Turnbull, J.	34	31	..	3	3	1	..	..

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.
Newcastle-on-Tyne	Elswick Works Mechanics and Literary Institute	Maughan, Rev. W.	Allan, G.	Rowden, W. T.	..	117	117	..	..	38	..	..
"	Mechanics' Institute	Snape, Rev. J.	McKendrick, J.	Wheatley, M. J.	..	16	16	..	..	2	..	..
New Mills	News Room, Market Street	Taylor, J.	Godward, E.	Hurst, W.	30	12	..	18	7	1	..	..
Newton	School-room	Dwarris, Rev. B. E.	Johnson, Rev. A.	Ingram, J. S.	..	21	21	..	..	..	..	..
Newton Heath	All Saints' National School	Hutchinson, Rev. W.	Hudson, T.	Parnell, G.	18	18	..	..	5	1	..	..
"	Dixon Street	Wright, R.	Brierley, J.	Stott, H., sen. Stott, H., jun.	..	12	12	..	..	..	..	..
Northampton	Museum and Town Hall	Compton, Rev. Lord A.	Hensman, J. B.	Lees, C. Leney, Miss	115	191	76	..	30	12	1 B.	1 B.
North Ormesby	Church Institute	Pennyman, J. S.	Sharrock, Rev. W. R.	Weatherill, R.	7	5	..	2	4	..	..	..
Nottingham	Mechanics' Institution	Morse, Rev. F.	Thurlow, R.	Taylor, A. C. Truman, E. B. Wilson, E. Major, H. Andrews, H.	61	232	171	..	17	4	..	..
Oldbury	National School	Taylor, Rev. W. T.	Gill, J.	Spencer, P.	61	68	7	..	12	1	..	..
"	Messrs. Chance's Institution	Chance, H.	Chance, A. M.	Horton, F. C.	14	76	62	..	..	..	..	..
Oldham	Science and Art Schools	Platt, J., M.P.	Bailey, T.	Phythian, J. P. Philip, J. Walters, C.	80	98	18	..	42	13	..	1 S.
"	Glodwick Mut. Imp. Soc.	Harrop, E.	Green, J.	Kershaw, T., jun. Platt, W.	30	76	46	..	14	8	..	..
"	Analytical Literary Inst.	Yates, J.	Hall, R.	Taylor, W. Haslam, W.	44	40	..	4	16	18	..	..
"	Parish Church School	Bamford, J.	Walters, Rev. W.	- - - -	33	24	..	9	..	..	..	..
Openshaw	Ashbury Carriage Works	Airey, Rev. J. P.	Ashbury, T., jun.	Tomkins, E.	..	29	29	..	..	9	..	..
"	Wesleyan Day School	Tyler, Rev. G. S.	Kay, J.	Hurst, W.	..	30	30	..	..	..	..	..
Oxford	Town Hall	Spiers, E. T.	Alden, E. C.	Gubb, E. J.	..	17	17	..	..	7	..	..
Padiham	National School	Fox, Rev. J. H.	Harland, T. D.	Shore, T. W.	10	11	1	..	..	..	1 S.	2 G.
Patricroft	Mechanics' Institution	Wilson, R.	Hewitt, J.	Tomkins, E.	27	18	..	9	17	8	1 B.	1 B.
Pavenham	Church of Eng. School-room	Tucker, J.	Ram, Rev. S. J.	Glover, A. W.	..	19	19	..	..	1	..	..
Pembroke Dock	Mechanics' Institution	Cocks, J.	Stunette, G. M.	Fitze, W. J.	..	15	15	..	..	..	..	..

Pendleton	National School	Aitken, Rev. R.	Bennett, J.	Oats, F.	..	7	7	..	..	..	..	..
Pendleton	Mechanics' Institution	Ashworth, J.	Clay, J., jun.	Beever, J.	20	10	..	1	4	2	..	..
„	Pendleton Club	Armitage, E., jun.	Armitage, B.	Stott, H., jun.	..	11	11	..	..	..	..	..
Penzance	School of Science and Art	Mathews, W. D.	Rodd, W. H.	Geoffroi, H. M.	24	28	4	..	4	8	..	..
Peterborough	St. Peter's College	Walker, T., M.D.	Savigar, J.	Girling, R. G. S. Tomlinson, J.	..	37	37	..	..	2	..	..
Plumstead	Burrage Road School	McAllister, Rev. J. A.	Hammond, J.	Shipman, C. Farlie, C. J. Candler, G. Downar, G. F.	57	83	28	..	58	15	..	1 G. 1 S.
Plymouth	Courtenay Street	Bate, C. S.	Cawse, J. H. M.	Rickard, G. J. Evers, H. Hingston, C. A. Rider, A. J. Merrifield, J. Balkwill, F. P.	103	141	..	22	81	40	1 G. 3 S. 4 B.	1 B.
„	Buckwell Street	Risk, Rev. J. E.	Widlake, T. H.	Hearder, J. N.	13	9	..	4	6	3	..	..
„	Navigation School	Hill, R.	Cuming, W. B.	Merrifield, J.	344	241	..	103	..	1	..	..
„	Charles National School	Greaves, Rev. H. A.	Cuddeford, T.	Evans, H. Foster, J. B.	..	74	74	..	..	15	..	..
Portland	The Grove School	Clifton, G.	Hill, Rev. A.	Moore, E. W.	30	23	..	7	2	..	..	..
Preston	Institution, Avenham	Myres, M.	Newsham, W.	Cope, J. G. Spriggs, C. Walley, T. J.	57	79	22	..	30	13	1 S. 1 B.	1 S.
Ramsbottom	Public Institute	Butcher, Rev. J. H.	Barlow, R.	Jones, T.	17	9	..	8	5	—	..	..
Rawmarsh	- - - - -	Ashcroft, Rev. T.	Simmonite, H.	Brears, W.	..	12	12	..	..	..	..	..
Rawtenstall	Mechanics' Institution	Whitehead, J. B.	Wardleworth, W.	Tomkins, E.	55	41	..	14	33	14	..	..
„	Irwell Inst.	Ashworth, R.	Anson, Rev. W. C. H.	Thornley, G.	..	12	12	..	..	..	..	..
Redditch	Literary and Scientific Inst.	Bartlect, R. S.	Sparrow, S.	Bryant, J. E. Hall, E.	..	40	40	..	..	..	..	..
Redruth	The Institution	Manley, Rev. W. L.	Grylls, W. M.	Phillips, W. Terrill, W., jun. Collins, J. H.	10	54	44	..	2	..	..	..
Riddings	Mutual Imp. Association	Walsh, Rev. T. H.	Wood, S. A.	Casson, J. H. Briffault, F.	..	28	28	..	..	..	..	1 B.
Rochdale	British Schools	Whitaker, C.	Belmont, E.	Tomkins, E. Duerr, G.	47	114	67	..	18	27	..	1 B.
Royton	St. Paul's National School	Whittaker, R.	Hill, Rev. R.	Taylor, W.	54	43	..	11	8	3	..	..
Rumworth	Sunnyside Institution	Barhall, Rev. W.	Ingham, J.	Monks, P.	..	15	15	..	..	..	..	..
Saddleworth	Mechanics' Institution	Shaw, G.	Platt, S.	Kaye, W.	..	17	17	..	..	..	..	..
St. Helen's	Commercial School	Mocatta, Rev. W. A.	Walthew, Rev. J. H.	Bournes, T.	23	20	..	3	4	..	..	..
St. Just	The Institution	Boyns, R.	Boyns, R.	Oats, F.	14	8	..	6	..	..	..	..
Salford	Working Men's College	Davis, T.	Plant, J.	Richardson, J. Law, E. Holl, J. Monks, P. Shorrocks, J. H.	53	80	27	..	11	15	.	1 B.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.
Salford	The Egerton Schools	Moore, Rev. J.	Unsworth, R.	Maybury, C. W.	..	34	34	..	..	..	..	..
Saltaire	Literary Institute	Kelly, Rev. W.	Morrell, G.	Severs, G.	..	24	24	..	..	2	..	..
Saltley	Training College	Smythe, Rev. P. M.	Smith, Rev. F.	Haworth, Rev. T. J.; Bulpitt, W. T.	20	66	46	..	37	16	..	..
Scarborough	Mechanics' Institute	Woodall, J. W.	Delamere, N. H.	Beevor, J.; Yewdall, J. H.; Potter, F.	..	18	18	..	..	..	..	..
Seaham	Colliery School	Daglish, J.	Warham, W.	Rowden, W. T.; Jack, D.	..	33	33	..	..	6	..	..
Seaton Delaval	Colliery School	Forster, T. E.	Sanderson, T.	Rowden, W. T.	..	54	54	..	..	8	..	..
Shaw	National School	Milne, H. T.	Bartleet, Rev. S. E.	Taylor, W.; Newton, L.	..	28	28	..	..	1	..	..
Sheffield	Chr. and Educ. Institute	Vickridge, Rev. E.	Wardlow, C.	Allen, A. H.; Turner, R.	..	15	15	..	..	..	..	..
"	St. Paul's School	Sale, Rev. T.	Buckle, A.	Harrison, G.	..	23	23	..	..	..	..	..
"	St. George's School	" "	"	Sanderson, N.	..	4	4	..	..	3	..	..
"	Church Institute	" "	"	"; Sutton, J.	..	35	35	..	..	5	..	..
Shrewsbury	School of Art	Lloyd, Rev. T. B.	Tasker, J.	Noyes, H. J.	..	4	4	..	..	1	..	..
Slough	Mechanics' Institution	Simpson, Rev. R. J.	Ward, W. H.	Dorrell, J.; Dorrell, C. F.; Dorrell, H. B.	28	58	31	..	4	12	..	..
Southampton	The Hartley Institution	Mayes, E.	Le Feuvre, J. B.	Bond, F. T.; Rankin, F.; Edmonds, F.	49	146	97	..	1	4	..	..
Southminster	National School	Page, W., jun.	Berkeley, Rev. G. C.	Fleming, J.	21	22	1	..	2	2	..	..
Southport	Athenæum	Boothroyd, S.	Craven, R.	Spriggs, C.	..	14	14	..	..	1	..	..
South Shields	Jarrow Works Mech. Inst.	Stevenson, J.C. M.P.	Noble, J.	Rowden, W. T.; Lange, G.	..	112	112	..	..	8	..	..
Southwick	Working Men's Reading Room.	Penney, R. H.	Frampton, J. W.	Pullen, M.	..	10	10	..	..	1	..	..
Stainland	Independent School	Watts, Rev. L. L.	Whiteley, F. W.	Welby, R.	..	9	9	..	..	1	..	..
Stalybridge	Mechanics' Institution	Marsland, J.	Wood, J.	Hurst, W.	..	19	19	..	..	5	..	..
Stockport	Mechanics' Institution	Higinbotham, H.	Stockdale, R.	Gee, W.; Davenport, T.; Davies, G. W.; Goodwin, J. W.	45	54	9	..	19	8	..	..

„	Sunday School Imp. Soc.	Wilkinson, S. W.	Hill, J.	Rathbone, T. H. Davies, G. W.	18	34	16	..	5	1	..	..
Stonehouse	The Institute	White, Rev. W. F.	Holland, Rev. P. E.	Smith, P. L.	..	4	4	..	..	1	..	..
Stourbridge	Grammar School	Freer, W. L.	Marten, E. B.	Welch, Rev. W. J. J.	..	16	16	..	..	..	..	..
Stratford	Working Men's Hall	Scott, Rev. T.	Mackey, G.	Swiss, H. Smith, H. H. Swiss, W. G.	58	58	..	..	37	19	..	..
Stroud	The Institute	Dickinson, S.	Philp, G. T. Gardner, H. F.	Vick, W. Okey, J. Smith, P. L.	29	89	60	..	11	4	..	..
Swansea	Royal Institution of South Wales and Oxford Street National School	Wilson, C. T.	Wilks, A. P.	Cole, F. Molison, A Scheffer, Dr.	45	92	47	..	4	19	..	..
Tavistock	British School	Straker, E.	Luxton, R.	Moffatt, W.	50	81	31	..	22	5	..	1 S.
„	Gulworthy School	Mitchell, Rev. J. B.	Phillips, W.	Evers, H. Gand, J. H. Gand, J. W.	34	68	34	..	9	3	1 B.	..
„	National School	Tancock, Rev. O. J.	Monk, H. E.	Rider, A. J. Merrifield, J. Loam, J.	..	68	68	..	..	4	..	..
„	St. Mary Tavy Nat. Sch.	Buller, Rev. A.	Lemon, Rev. C.	Moffatt, W.	..	14	14	..	..	..	..	..
„	School of Art	Honey, W.	Greenfield, T. W.	Robjohns, F. R.	..	15	15	..	..	2	..	..
Tebworth	Wesleyan School	Seccombe, Rev. W.	Gurney, N.	Mackrell, I.	13	11	..	2	3	..	..	..
Thorne	Brookes' Grammar School	Jannings, Rev. G.	Lister, W.	Constable, J.	17	23	6	..	5	..	..	..
Thorpe	St. Matthew's Boys' School	Owen, Rev. J. S.	Caley, J. W.	Marsh, W. H.	..	8	8	..	..	..	..	..
Toddington	National School	Cooper, W. C.	Clegg, Rev. J.	Billingham, E.	..	2	2	..	..	..	..	..
Torquay	School of Science and Art	Sheppard, A. G. R.	Laxmoore, C. N.	Viccars, T.	63	90	27	..	23	23	1 B.	..
Towcester	National Schools	Hesketh, Sir T. G. F., Bart., M.P.	Lightfoot, Rev. R. P.	Jones, J. C.	..	50	50	..	..	2	..	..
Truro	British School	Tweedy, R.	Clymo, G.	Snell, J.	..	17	17	..	..	..	..	..
„	Royal Institution	Barham, C.	Mayne, J. O.	Collins, J. H.	..	24	24	..	..	..	..	..
Turton	Chapel Town Institution	Spencer, Rev. T. O.	Haworth, T.	Stott, H.	..	26	26	..	..	4	..	..
Tyldesley	Mechanics' Institution	Green, G.	Lomax, W.	Stott, H., jun.	..	30	30	..	..	8	..	..
Ulverstone	Temperance Hall	Fell, J.	Sykes, J. S.	Eckersley, H.	18	9	..	9	2	..	..	..
Wakefield	Holy Trinity Young Men's Society.	Madden, Rev. W. M.	Dixon, J. H.	Patchett, I.	..	18	18	..	..	4	..	..
Wakefield	Mechanics' Institution (Schoolmaster's Class).	Holdsworth, S.	„ „	Jarmain, G.	..	31	31	..	..	..	..	..
Warrington	Museum and Free Library	Beamont, W.	Webster, G. W.	Bournes, T.	102	26	..	76	6	2	..	..
Weedon	Girls' School	Winter, Rev. J. S.	Williamson, Rev. A.	Norman, S. A.	..	42	42	..	..	..	..	..
Wellingborough	Lower Grammar School	Broughton, Rev. H.	Roxby, Rev. H. M.	Winterton, W. Sturgess, W.	30	52	22	..	12	4	..	..
Werneth	Mechanics' Institution	Milnes, T.	Chadderton, F. H.	Mellor, J.	33	34	1	..	14	1	..	..
West Bromwich	St. Peter's School	Massey, Rev. C.	Jesson, Rev. H.	Hill, S. T.	..	20	20	..	..	..	..	..

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.
Westbury-on-Trym	Girls' National Schoo	Bright, Rev. J. H.	Pease, T.	Plant, E. C. Plant, A. U.	..	36	36	..	..	9	..	..
West Gorton	St. Mark's National School	Connell, Rev. A.	Jackson, T.	Ward, R. P.	..	25	25	..	..	..	..	..
Whaleybridge	Mechanics' Institution	Kirk, J.	Colles, A. H.	Stott, H.	19	12	..	7	2	1	..	..
Whitworth	Literary Institution	Kay, E. G.	Lord, J.	Sutcliffe, G. W.	..	24	24	..	..	3	..	..
Wigan	Town Hall	Fergie, Rev. T. F.	Peace, M. W.	Betley, R. Percy, C. M.	71	91	20	..	17	6	1 B.	..
Wilsden	Mechanics' Institution	Clapham, P.	Watmuff, W. G.	Severs, G.	..	11	11	..	..	1	..	..
Windsor	Mechanics' Institution	Gooch, Sir D., Bart., M.P.	Rawlins, Rev. F. J.	Dorrell, J. W. Dorrell, H. B.	..	30	30	..	..	5	..	..
Wisbech	Working Men's Institute	Scott, Rev. J.	Balding, A.	Miller, S. H.	24	40	16	..	7	..	..	..
Woking	St. John's School	Wilks, Rev. T. C.	M'Cormack, R.	Goffin, R. Goffin, J.	..	53	53	..	..	..	..	..
Wollaston	Church of England Schools	Gilbanks, Rev. G.	Boden, G.	Packer, M. W.	..	18	18	..	..	..	..	..
Wolverhampton	Athenæum	Iles, Rev. J. H.	Langley, J. N.	Packer, M. W.	12	17	5	..	13	3	..	1 S.
„	St. Peter's School	„ „	„ „	Horton, F. C. Booth, H. C.	38	64	26	..				
„	St. Luke's School	Parry, Rev. J.	Wilkes, M.	Breakwell, W.	8	14	6	..	1	..	..	..
„	St. John's School	Hampton, Rev. H.	-	Board, G.	4	18	14	..	..	..	..	..
Wolverton	Science and Art Institution	Mumford, A. L.	Meadley, J.	Harnett, Rev. F. W. Davison, W. Nichols, T. Goyer, A.	65	82	17	..	18	7	..	..
Woodville	National School	Wilmshurst, Rev. A.	Betterton, H. T.	Binns, A.	..	13	13	..	..	2	..	..
Woolwich	Royal Arsenal Sci. Classes	Oram, W. E. S.	Keeble, W. D.	Jones, T. Noble, J. Clarke, J. J. Duckett, W. Brittle, J. R.	144	171	27	..	55	42	1 B.	1 B.
„	National School	Brown, Rev. H.	Harrison, Rev. F. S.	Farlie, C. J. Swiss, H.	40	55	15	..	33	2	..	..
„	St. Thomas' School	Robertson, Capt., R.N.	Norman, J. H.	Busbridge, W. Hopper, T. Hardy, J. Downar, G. F. Charlesworth, T. Ellis, A.	95	107	12	..	72	31	1 B.	..

„	Presbyterian District School	Thompson, Rev. W.	Ronald, H.	Jones, T.; Browne, L.; Lomas, C.; Redding, R. J.; Courtman, R. S.; Browne, F.	96	125	27	..	8	1	..	..
„	St. Michael's School	Baker, Rev. H. R.	Ruegg, L. J.	Byatt, H.; Farlie, J. L.; Stanton, G.	15	34	19	..	13	1	..	..
„	Rectory Place School	Balgarnie, Rev. R.	Fairbrother, W.	Hepburn, R.	..	21	21	..	..	3	..	..
„	13, Dundas Terrace	Oram, W. E. S.	Keeble, W. D.	Jones, E. S. L.	..	21	21	..	..	†	..	..
Worcester	Guildhall	Webb, W.	Day, H.	Ewens, F. T.	71	104	33	..	10	10	..	..
„	School of Art	„	„	Plant, E. C.	..							
„	Workman's Hall	Wood, J.	Walter, W. H.	Spencer, J.; Gwinnell, W. F.	..	72	72	..	..	1	..	..
Yarmouth, Great	Navigation School	Fellows, H.	Bracey, J.	Stockton, W.	81	98	17	..	1	1	..	..
York	The Institute	Palmer, Rev. H. V.	Hall, R.	Proctor, W.; Hewison, Rev. G.; Robinson, F.	80	51	..	29	6	2	..	..
„	Blue-coat School	Richardson, W.	Ford, J.	Robinson, E.	..	20	20	..	..	1	..	..
„	Training College	Hay, Rev. Canon	Bresher, Rev. M. R.	Rowe, Rev. G.	..	16	16	..	..	..	..	..

SCOTLAND.

Aberdeen	Mechanics' Institute	Matthews, J.	Sinclair, J.	Beveridge, R.; Maver, D.	61	280	219	..	3	2	..	..
„	*Navigation School	Forbes, D.	Kellas, J. F.	Jones, J. R.	317	298	..	19	..	..	..	..
Aboyne	Parish School-room	McKenzie, Rev. J.	Coutts, J.	Summerfield, E.	..	22	22	..	..	1	..	..
Alexandria	Mechanics' Institute	Ewing, G. Orr	Greenlees, W.	Tatlock, R. K.; McIntyre, R.; Andrew, D.	..	99	99	..	..	..	..	..
Banchory	Lady Burnett's School	Hutchison, Rev. G.	Stewart, J.	Ritchie, G.	13	17	4	..	6	3	..	..
Banton	Banton School	McPherson, J.	Walker, J.	Forbes, A.	..	17	17	..	..	4	..	..
Beith	New Street School	Muir, W.	Kerr, J.	Cook, W.	7	24	17	..	..	..	..	..
Brechin	School-room	Scott, D.	Craig, J.	Cameron, J.	..	31	31	..	..	..	..	..
Corsock	Girls' School	Sturrock, Rev. G.	Currie, R.	Macomish, M.	13	12	..	1	4	..	..	..
Cults	School-room	Paul, Rev. W.	Taylor, J.	Summerfield, E.	..	13	13	..	..	2	..	..
Cupar	Madras Academy	Hood, R.	Taylor, W. A.	Reid, W.; Bonnar, G. L.	..	40	40	..	..	..	..	..
Dalry	Blair Iron Works School	Biggart, J.	Loudon, A.	Stevenson, J.	..	19	19	..	..	..	..	..
Dumbarton	Burgh Academy	McNeil, T.	Babtie, J.	Dickie, H.	12	114	102	..	..	6	..	..
Dundee	High School	Thoms, W.	Cumming, A. W.	Kennedy, J.	70	90	20	..	6	5	1 G.; 1 B.	..

† Included with Royal Arsenal.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	Number of Individuals under Instruction. 1869.	Increase.	Decrease.	Number of Prizes. 1868.	Number of Prizes. 1869.	Number of Medals. 1868.	Number of Medals. 1869.
Edinburgh	Free Church Training College.	Chambers, W. (Lord Provost).	Archer, Prof.	Lees, W. Kennedy, W.	..	49	49	..	..	18	..	..
"	Watt Institution	" "	"	Pryde, J. Lees, W. Macadam, S.	..	377	377	..	..			
Glasgow	Secular School	McClelland, J.	Cunliff, R. S.	Mayer, J. Mayer, E. Lochore, J. Stone, W.	80	113	33	..	22	6	..	..
" †	Andersonian University	Young, J.	Martin, G.	Herschel, A. S. Buchanan, G. Penny, F. Hennedy, R. Laing, A.	730	1,013	283	..	33	10	1 B.	..
" †	Mechanics' Institution	Neilson, W. M.	Anderson, J.	Moffat, R. C.	950	500	..	450	7	..	1 S.	..
"	Estab. Church Normal Sch.	Craik, Rev. J.	Snodgrass, G. W.	Dixon, R. M.	..	74	74	..	..	9	..	..
"	East End Schools	Osborne, A.	Chapman, G.	Mayer, J.	..	107	107	..	..	..	..	..
Inverness	School of Science and Art	Simpson, A.	Galloway, G.	Bain, R. L. Robertson, G. W.	27	18	..	9	3	..	..	..
Kilmarnock	Foulds Street	Dickie, J.	Stewart, J.	Stevenson, J. Neil, J.	76	127	51	..	14	..	..	..
"	New Academy	Webster, Rev. A.	Mackay, J.	Gunnyon, W.	..	50	50	..	..	8	..	..
Kirkwall	Grammar School	Robertson, J.	Heddle, P. S.	Watson, Rev. J. Burns, R.	10	53	43	..	..	..	..	..
Leith	Navigation School	Watt, J.	Thomson, Rev. J.	Bolam, J.	228	289	61	..	..	1	..	..
Newhills	Stoneywood School-room	Smith, J.	Black, G.	Williamson, W. A.	17	30	13	..	..	2	..	..
Perth	School of Art	Barclay, H.	M'Neil, J.	Hutton, D. C.	..	15	15	..	..	3	..	..
Rutherglen	Free Church School	Murray, D.	Bowers, J.	Stone, W.	..	22	22	..	..	..	..	..
Stirling	Science and Art School	Morris, J.	Shearer, R. S.	Baker, L.	..	18	18	..	..	2	..	..
Tarbat	Parochial School	Campbell, Rev. G.	Mackie, J.	Fraser, Rev. D.	16	11	25	..	1	..	..	..

IRELAND.

Anahilt	Endowed Free School	Erwin, Rev. R. S.	Moorhead, Rev. R.	Clements, A.	..	19	19	..	..	..	..	..
Antrim "	Male National School Main Street National School	Viscount Massareene	Taggart, W. J.	Savage, H. Speers, R.	66	78	12	..	14	3	..	..
Athlone	St. Mary's Parochial School	Handcock, Hon. R.	Berry, Rev. E. F.	James, M. H.	37	50	13	..	16	3	2 B.	..
"	Ranelagh School	"	"	Cavanagh, J. McIntosh, W. T.	32	36	4	..	35	1	..	..
Bagenalstown	School-room	Morrin, Rev. P.	Brennan, Rev. E.	Fitzgerald, E.	39	52	13	..	7	2	..	..
Bailieboro'	Model School	Dalton, G. T.	Simpson, A. J.	Doherty, J. J.	84	125	41	..	38	20	1 G. 1 S.	..
Ballybay	National School	Burdett, Rev. H.	Breakey, W. A.	McClean, W.	..	16	16	..	..	1	..	..
Ballyblack	School-room	Parke, R. C.	Mitchell, Rev. W.	Gebby, R.	..	13	13	..	..	..	..	..
Ballycarry	National School	Dalway, M. R.	Smiley, A.	M'Giffin, R. M'Connell, F.	24	16	..	8	7	..	..	..
Ballykinlar	National School	O'Hara, Rev. J.	Smith, P.	Skeffington, J. B.	..	79	79	..	..	..	..	..
Ballymena	Model School	Rowan, Rev. R. W.	Wilson, D. M.	Shannon, A. F.	18	28	10	..	4	2	..	..
"	Guy's National School	Patrick, J.	Killen, J.	Alexander, J.	..	28	28	..	..	1	..	..
Ballymoney	Town Hall	M'Elderry, T.	M'Elroy, S. C.	Elliott, T.	..	39	39	..	..	2	..	..
Ballynahinch	Town Hall	Anketell, W. R.	Davis, Rev. J.	Priestley, J. R.	..	29	29	..	..	..	..	..
"	National School	Crauford, J.	Bradley, Rev. W.	Goodman, J.	..	12	12	..	..	..	..	..
Ballywalter	Park School	Wilson, Rev. H.	Gibson, J.	M'Kimm, S.	..	56	56	..	..	..	..	..
Ballywilly	National School	Irwin, Rev. J.	MacShane, Rev. C.	Nugent, F. Lee, H.	19	23	4	..	..	..	..	..
Banbridge	Scarva Street N.S.	Rutherford, Rev. J.	Anderson, Rev. R.	Gillespie, J.	64	19	..	45	15	5	..	..
Bangor	Endowed School	M'Cullagh, Rev. J.	Patteson, Rev. W.	O'Reilly, J. C. Scott, S. M.	..	25	25	..	..	..	..	..
Belfast	Fisherwick Place School	Browne, W.	Shepherd, W.	Cleeland, R. Elliott, T.	83	76	..	7	18	6	1 B.	..
"	Milford Street National Sch.	Morrison, Rev. A.	"	Collins, T.	35	11	..	24	4	..	..	..
"	Cromac Street	" "	"	McDowell, H.	..	17	17	..	..	..	..	..
"	May Street National School	" "	"	Cullen, W. Carroll, J.	27	21	..	6	3	..	..	..
"	Union Place National Sch.	Browne, W.	"	Anderson, J.	..	25	25	..	..	..	..	..
"	70, Albert Bridge Road	"	"	Mangnall, J.	..	9	9	..	..	..	..	..
"	Conway Street National Sch.	McCausland, S.	"	Kerrigan, J.	..	23	23	..	..	..	..	..
"	Model School	Alexander, Capt.	Molloy, J.	Doran, G. Wren, E. Smeeth, R.	141	122	..	19	40	8	..	..

† Out of the 1,518 students at these two schools, only 134 applied for examination in 1869.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.
Belfast	Academy Street, No. 1 National School.	M'Causland, S.	Hanna, Rev. H.	Barbour, S.	13	29	16	..	7	6	..	..
„	Academy Street, No. 2 National School.	„	„	Campbell, D.	..	14	14	..	..	..	..	..
„	Smithfield National School	„	„	Robinson, J.	..	15	15	..	..	..	..	..
„	Glentilt Place	Cotter, Rev. W.	Shepherd, W.	Robertson, W.	..	10	10	..	..	..	..	..
„	Brown Street National School.	Lytle, J.	Johnston, Rev. W.	Donaldson, T.	..	80	80	..	..	2	..	..
„	Nelson Street National Sch.	Knox, Rev. R.	Hannah, S.	Bingham, H.	..	14	14	..	..	5	..	..
„	People's Literary Institute	Lanyon, Sir C.	Maitland, F. A.	Whitford, W. Perry, J. Drennan, A.	..	117	117	..	..	3	..	..
Bessbrook	School-house	Lett, Rev. H. W.	Wonfor, W. J.	Lyons, M.	21	12	..	9	2	..	..	..
Braidwater	National Schools	Kidd, A.	Lynch, Rev. J.	Black, R. McCormick, J. O'Neill, A.	15	12	..	3	3	1	..	..
Brookfield	Agricultural School	Richardson, J. J.	Swann, T.	Pedlow, G.	..	23	23	..	..	..	..	..
Broughshane	National School	Davison, A.	Patman, E.	Alexander, J.	..	32	32	..	..	5	..	..
Caledon	School-house	Prentice, H. R.	Armstrong, Rev. W.	Brownlee, T.	..	17	17	..	..	..	..	..
Carlow	Christian Schools	Tynan, M. F.	Hade, A.	Mayne, A. J.	21	29	8	..	1	4	..	..
Carrickfergus	Model School	Birnie, T. M.	Pasley, D.	Stevenson, J. M.	42	59	17	..	16	8	..	..
Carrowdore	National School	Crommelin, S. A. H.	Gilmore, Rev. A. G.	Clements, W. T.	..	53	53	..	..	6	..	..
Castlederg	Edward's School, &c.	Edwards, Rev. E.	Crockett, Rev. J.	M'Granahan, W.	..	25	25	..	..	..	..	..
Castlefin	National School	Smith, C.	Elliott, T.	O'Flanagan, T.	..	6	6	..	..	..	..	..
Clohanbeg	National School	O'Gorman, W. S.	Quinlivan, Rev. M.	Hunt, T.	..	7	7	..	..	..	..	..
Clonakilty	National School	Lucey, Rev. J.	Mulcahy, Rev. J.	Prendergast, P.	..	8	8	..	..	..	..	..
Cloncore	National School	Clements, Rev. W.	M'Varry, Rev. T.	Lee, H. Nugent, F.	..	8	8	..	..	6	..	..
Coleraine	Model School	Bruce, Sir H. H., Bart., M.P.	Bole, W.	Bresland, J.	60	28	..	32	14	5	..	..
Comber „ „	Smyth's National School No. 1 National School Lisbarnet National School	Rogers, Rev. J.	Withers, R.	Watt, W. D. Lootoh, J. Browne, W. J. Cleland, J. M.	96	92	..	4	15	1	..	..
Cooraclare	National School	O'Gorman, W. S.	Quinlivan, Rev. M.	M'Dermott, C.	40	71	31	..	14	23	..	..

Cork	District Model School	Macnamara, Rev. A. D.	M'Cord, Rev. G. M.	Linehan, P. Latchford, G. D. Latchford, Mrs. G. D. Finnegan, B. M.	65	61	..	4	34	4	1 B.	..
"	Carmichael School	M'Ostrich, A.	Magill, Rev. W.	Robinson, J.	..	78	78	..	..	5	..	..
Cormeen	National School	Bailey, Rev. W. R.	Fleming, T	M'Clean, W.	..	31	31	..	..	..	..	..
Crebilly	National School	Kidd, A.	Lynch, Rev. J.	M'Cormick, J.	..	5	5	..	..	..	..	..
Dartreyhouse	National School	Earl of Dartrey	Stewart, J.	MacMillen, R.	..	85	85	..	..	..	..	..
Derrylin	National School	Benison, J. J.	Winslow, H. M.	Doogan, P.	..	11	11	..	..	1	..	..
Donaghadee	National School-house	M'Minn, A.	M'Aulay, Rev. J.	Scott, S. M. O'Reilly, J. C.	..	16	16	..	..	7	..	..
Donegal	National School	Mulvany, Rev. R.	Hamilton, A.	Patterson, W.	..	12	12	..	..	..	..	..
Donoughmore	Presbyterian Lecture-room	Quinn, Rev. J. C.	Elliott, Rev. J.	Williams, T. M.	..	14	14	..	..	..	..	..
Downpatrick	Young Men's Christ. Assoc.	Davis, W.	Pilson, C.	Bell, J.	20	28	8	..	10	1	..	..
"	John Street National School	Pilson, C.	Clarke, J.	Fitzpatrick, S.	..	53	53	..	..	1	..	..
Drogheda	St. Mary's National School	Mathews, Rev. J.	McGreevy, N.	O'Shea, M. J. Dolan, J.	29	31	2	..	2	7	..	..
Drumlough	National School	Chambers, J.	M'Clelland, J.	Mackintosh, J.	..	12	12	..	..	2	..	..
Dublin	Central Model School	Newell, W. H.	Butler, E.	Joyce, P. W. Smeethe, J. F.	127	213	86	..	31	7	..	..
"	King's Hospital School	Flynn, J. H.	Dobbin, Rev. W. P.	Macbeth, J.	46	44	1	..	6	..	..	..
Dundalk " " "	Free Library Quay Street School Educational Institution Jocelyn Street School	Byrne, P. J.	Hesse, J.	Lyons, M. Armstrong, G. M'Ewen, H. Leonard, T. R. Gillespie, I.	62	90	28	..	52	25	1 G.	1 B.
Dungannon	Erasmus Smith's School	Newton, C.	Gaussen, Rev. E. J.	Orr, J.	..	29	29	..	..	..	..	..
Eglish	National School	Robinson, Rev. G.	Kane, Rev. J. B.	Hyde, S.	51	20	..	31	5	..	..	..
Enniscorthy	Model School	Cranfield, T. G.	Boland, G. E.	Kelly, D.	40	32	..	8	7	3	..	..
Enniskillen	Town Hall	Greer, Rev. S.	Bagot, E.	Doogan, P.	17	16	..	1	2	1	..	..
"	Model School	"	"	Morris, C.	..	39	39	..	..	..	..	..
Galgorm	National School	Young, J.	Raphael, J., jun.	M'Ilroy, H.	36	24	..	12	16	1	1 B.	..
Galway	Model School	Persse, T. M.	Gordon, J.	Moylan, J.	43	51	8	..	5	..	..	..
Gilford	National School	McMaster, J. W.	Kidd, H.	Martin, H.	35	49	14	..	8	2	..	..
Greyabbey	National School	Montgomery, H.	Hall, Rev. W.	Walker, W.	..	49	49	..	..	..	..	..
Holywood	Sullivan's Schools and Academy.	Henderson, Rev. H.	Foster, A. F.	Speers, A. Carse, W. Drennan, A. Jenkinson, E. D.	76	117	41	..	18	7	..	..
Irvinestown	National School	Evans, Rev. S.	M'Quaid, Rev. J.	Magennis, P.	..	16	16	..	..	..	..	..

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.
Kilkenny - -	Model School - - -	Blunden, Sir J., Bart.	De Montmorency, Rev. W.	Ryan, L. J. - -	46	44	..	2	9	1	..	..
Killylea - -	Schoolhouse - - -	Cross, Lt.-Col. W. -	Ellis, Rev. T. - -	Brownlee, T. - -	..	43	43	..	..	1	..	..
Kilmore - -	Kilmore School - -	Irvin, Rev. C. K. -	Paton, Rev. J. -	Baile, R. - Hyde, S. -	..	18	18	..	..	..	..	..
Kircubbin - -	National School - -	Lyle, Rev. E. A. -	Rowan, Rev. J. -	Walker, W. - -	..	14	14	..	..	..	..	..
Larne - - -	Model Agricultural School -	Morgan, Rev. T. P. -	Eccles, Wm. - -	Hay, W. - - -	49	30	..	19	15	3	..	1 B.
" - - -	North End National School	" -	" - -	O'Neill, S. - -	41	42	1	..	10	..	..	..
Letterkenny -	National School - -	Gallagher, J. - -	Barrett, J. - -	M'Caffery, W. - -	..	34	34	..	..	1	..	..
Ligoniel - -	Wolfhill Mill - - -	Montgomery, J. -	Orr, W. - -	Barbour, S. - -	19	27	8	..	5	12	..	1 B.
Lisbellaw - -	Court-house - - -	Wilson, Rev. J. -	Rudd, Rev. T. - -	Doogan, P. - -	..	8	8	..	..	..	..	..
Lisded - - -	National School - -	Reade, Rev. L. -	M'Nulty, Rev. T. -	Magennis, P. - -	..	16	16	..	..	..	..	..
Lisnagry - -	Ahane National School -	Bourke, R. - -	Walsh, Rev. J. -	Carey, J. - -	..	20	20	..	..	..	..	..
Londonderry -	Model School - - -	Smyth, R. - -	Dugan, C. W. - -	Gleeson, P. V. - -	..	41	41	..	..	..	..	..
Lough Cutra -	National School - -	Gough, G. S. - -	Stapleton, W. R. -	Cusack, M. - -	..	4	4	..	..	..	..	..
Loughgall - -	School-room - - -	Cope, J. A. M. - -	Thompson, W., jun.	Orr, J. - - -	..	12	12	..	..	1	..	..
Lurgan - - - " - - - " - - -	National School - - Model School - - - Mechanics' Institution -	Hancock, J. - -	Magahan, F. W. -	Mooney, T. - Porter, G. - English, W. -	61	104	43	..	18	2	..	..
Magherally - -	National School - -	Corken, R. - -	Reade, Rev. G. F. -	M'Cahy, A. - -	..	10	10	..	..	..	..	..
Manorhamilton -	Mutual Imp. Assem. Rooms	Donnelly, J. O. -	Shaw, S. - - -	Birney, J. - -	..	30	30	..	..	..	..	..
Markethill - -	Coolmalish National School	O'Toole, Rev. D. -	Cuming, W. - -	Lee, H. - Nugent, F. -	20	13	..	7	4	..	..	..
Monaghan - -	Model School - -	Lloyd, J. - - -	Bardley, F. - -	M'Entee, M. - Linehan, P. -	..	102	102	..	..	10	..	..
Newry - - -	Model School - - -	Dodd, Rev. J. - -	Porter, D. C. - -	Leonard, F. M. -	41	16	..	25	..	..	..	..
Newtownards -	Model School - -	Young, Rev. J. -	Macdonnell, J. -	Harbison, M. - Greer, W. H. - O'Reilly, J. C. - Scott, S. M. -	134	148	14	..	50	..	1G. 1S. 1B.	..
" - -	East Street National School	Macaulay, Rev. M. -	Doggart, H. J. -	M'Kimm, S. - -	..	31	31	..	..	1	..	..
Newtownbreda -	National School - -	Kennedy, J. - -	Anderson, Rev. W. -	Erwin, M. - -	33	29	..	4	..	..	..	..
Oldcastle - -	Endowed School - -	Durdin, Rev. J. G. -	O'Neill, R. - -	Beatty, J. - Smyth, A. -	190	201	11	..	26	40	1 S. 1 B.	1 G.
Omagh - - -	Model School - -	Byrne, Rev. J. -	Adair, S. - - -	Ferguson, S. H. -	..	46	46	..	..	11	..	..

[illegible]	Model School	The Earl of Rosse	Brown, S.	Muldoon, C.	..	25	25	..	..	5	..	..
Portadown	Town Hall	Shillington, T. A.	Donnelly, Rev. J.	Hyde, S.	30	30	..	..	9	..	..	..
"	Edenderry National School	Armstrong, T.	Wallace, H.	Martin, H.	..	18	18	..	..	1	..	..
Raphoe	National School	Thomson, Rev. J.	Wilson, T.	Cotter, B. G.	18	6	..	12	10	..	..	..
"	Court-house	Weir, Rev. J. A.	Morrow, H.	"	..	7	7	..	..	..	..	..
Rathfryland	Town Hall	Smyth, Rev. H.	Meek, B. B.	Williams, T. M.	..	17	17	..	..	..	..	..
Roscrea	National School	Meagher, Rev. J.	Somers, J. L.	McGrenahan, E.; Kelly, T.; Ryan, M.	9	36	25	..	7	5	..	..
Rosscarbery	Mount Fachnanus N. S.	Lucey, Rev. J.	Mulcahy, Rev. J.	Prendergast, P.	..	40	40	..	..	..	..	..
Santry	Training School	West, Very Rev. J.	Hackett, Rev. J. W.	Engledow, W. H.; Mayne, A. J.	60	91	81	..	87	4	1 S. 3 B.	..
Scariff	National School	Sampson, F. C.	O'Malley, Rev. P.	O'Gorman, T.	..	33	33	..	..	..	..	..
[illegible]	National School	Mann, D.	Junk, Rev. T. W.	Crooks, S.	..	21	21	..	..	1	..	..
Stewartstown	School-room	M'Curdy, Rev. S.	Jones, Rev. J. W.	Hyde, S.	..	24	24	..	..	..	..	..
Tandragee	Duke's School	O'Brien, J. S.	Victor, W. L.	Macgowan, F. M.	..	19	19	..	..	..	..	..
Trim	Model School	Lightburne, H.	Conwell, E. A.	Freehill, M.	62	95	34	..	23	7	..	..
Tullynamullen	National School	Johnston, Rev. W.	M'Neice, S.	Allen, D.	..	11	11	..	..	..	..	..
Waterford	Model School	Hoare, Very Rev. E.	Cavet, James	Dowling, J.	55	34	..	21	8	2	..	..
"	Newtown School	"	" "	Cane, J. B. N.	..	43	43	..	..	..	..	..
"	Leper Hospital	"	" "	"								
				Total	14,022	24,865	10848	—	3,616	1,969		

525 Schools.

TABLE II.

TABLE showing the CLASSES in each of the preceding SCIENCE SCHOOLS, the SUBJECTS taught, and the NUMBER of STUDENTS in each Subject. May 1869.

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
		ENGLAND.																							
Abingdon - -	British School - -	62	..	..	..	..	..	..	..	..	..	10	..	..	..	50	..	..	..	..	..	..	..	..	2
Accrington - -	Mechanics' Institution -	39	22	22	22	..	..	..	..	10	11	15	8	..	..	12	..	..	..	..	..	..	..	..	..
Alderley Edge -	Reading Room and Library	16	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Almondbury -	Grammar School - -	25	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..
Alnwick - -	Mechanics' Institution -	38	..	..	..	15	..	..	..	..	..	26	..	..	..	..	..	..	..	..	..	..	..	..	..
Altrincham and Bowdon.	Literary Institution - -	48	48	5	43	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Andover - -	Grammar School - -	31	..	..	..	..	..	..	..	..	..	..	..	..	..	31	..	..	..	..	..	..	..	..	..
Ashby-de-la-Zouch -	Mutual Imp. Soc. - -	27	..	..	..	..	..	..	..	..	1	21	..	..	..	..	..	..	1	..	..	..	..	..	..
Ashton-under-Lyne	Mechanics' Institution -	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Aston - -	Christ Ch. Mut. Imp. Soc. -	19	..	..	..	..	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..	..
Bacup - -	Mechanics' Institution -	35	19	19	19	..	..	10	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..
" - -	Wesleyan Day Schools -	10	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..
Balham - -	Working Men's Institute -	18	18	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Banbury - -	British School - -	47	..	..	..	15	..	..	..	..	..	..	..	..	..	36	..	..	..	..	..	..	..	..	..
" - -	Mechanics' Institution -	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..
Banstead - -	School-room - - -	33	..	..	..	..	..	..	..	..	33	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Barnard Castle - -	Mechanics' Institution -	10	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Barnsley - -	Market Street School -	17	14	2	2	..	..	..	..	2	3	..	..	..	..	..	..	..	..	1	..	..	..	..	..
Barnstaple - -	Lit. and Sci. Institution -	78	..	..	..	78	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Batley - -	Mechanics' Institute -	8	..	..	..	..	..	..	..	8	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..
Beccles - -	Leman School-room - -	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9
Bedford - -	St. Mary's Parish School -	21	..	..	..	..	..	..	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..
Bingley - -	Mechanics' Institution -	19	..	..	..	..	..	..	..	..	8	18	..	..	..	..	..	..	..	..	..	..	..	..	..
Birkenhead - -	School of Art - - -	30	20	8	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Birmingham -	B. and Midland Institute -	280	..	..	..	..	..	..	..	..	87	103	..	..	..	18	..	9	..	..	..	..	..	..	52
"	School of Art - - -	77	22	55	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

"	Clarendon Chambers	30	..	13	7	..	..	..	..	..	11	5	..	..	..	5	..	..	..	..	..	..	..	..	..
"	Bloomsbury Institute	104	18	20	18	..	..	..	..	9	31	11	..	9	..	31	..	..	..	..	..	..	..	..	..
"	Graham Street Institute	24	..	..	..	..	..	..	..	..	..	13	..	..	..	13	..	..	..	..	..	..	..	..	..
"	Church of the Saviour School.	20	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..
"	St. George's School	58	..	..	..	..	..	..	..	..	..	..	..	..	..	49	58	..	..	..	..	..	..	..	..
"	St. Paul's School	66	..	..	..	..	..	..	..	..	66	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	12, Ann Street	14	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..
"	St. Mary's School	16	..	..	..	..	..	..	..	..	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Mark's School	50	..	..	..	..	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	57
"	St. Clement's School	20	..	18	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Deritend W. M. Association	23	..	..	..	3	..	3	..	..	20	..	..	..	..	20	..	..	..	..	..	..	..	..	..
"	New Jerusalem School	7	..	..	..	..	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..
"	Middle Class School	19	..	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Bishop Ryder's Nat. Sch.	40	15	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..
Birstall	Mechanics' Institution	58	..	..	..	..	..	..	..	..	32	33	6	..	..	..	..	..	..	..	..	..	..	..	24
Blackburn	Wesleyan School	35	21	21	..	..	..	..	..	9	12	12	2	..	..	18	2	..	..	..	..	..	..	..	..
"	Church Institute	6	..	..	..	..	..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..
Blackley	Assembly Room	31	31	31	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Blyth	Waterloo School	46	46	46	46	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bodmin	Literary Institution	69	..	..	..	..	..	..	..	..	9	..	..	..	..	60	..	..	..	..	..	..	..	..	..
Bolton	Science and Art School	161	48	50	50	..	..	16	17	14	14	40	..	7	..	48	..	..	..	..	12	..	..	14	15
"	Mechanics' Institution	64	56	59	60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Boston	National School	26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	35	..	..	..
"	School of Art	18	3	10	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bow, North	Old Ford School-room	20	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bradford	Mechanics' Institution	10	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..
Breage	Wheal Vor, Sithney, and Cross.	52	..	..	..	..	..	..	..	..	..	32	..	20	34	..	..	..	..	30	8	..	..	..	..
Brighouse	Mechanics' Institute	11	..	..	..	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..
Brigstock	Farming Woods School	53	..	..	..	6	..	..	..	..	..	..	..	..	..	53	..	..	..	..	..	..	..	..	..
Bristol	Trade School	200	180	134	112	92	..	91	57	..	93	102	102	..	..	..	..	..	..	6	..	..	..	..	..
"	Young Men's Chr. Assoc.	17	..	..	..	..	..	..	..	..	8	13	..	..	..	7	..	..	..	..	..	..	..	..	..
Brixworth	Boys' School-room	30	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bromsgrove	Literary and Mech. Inst.	66	..	..	..	..	..	..	..	..	..	..	..	..	..	66	..	..	..	..	..	..	..	..	..
Buckingham	National School	11	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Burnley	Literary Institution	47	30	30	6	..	..	10	..	..	6	8	2	..	..	14	..	6	..	..	..	..	..	..	30
"	Carlton Road School	50	..	..	..	..	..	..	..	..	..	55	..	..	..	19	..	..	..	..	..	..	..	..	..
"	Mechanics' Institution	77	..	45	45	..	..	5	..	..	3	8	3	..	..	15	..	..	..	..	..	..	..	..	20
Burnley	Grammar School	40	..	..	..	..	..	..	..	..	..	40	..	20	..	..	..	..	..	..	..	..	..	..	..
Bury	Athenæum	77	74	75	77	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Caistor	Lower Grammar School	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13
Camborne	Basset Street	12	..	..	..	..	..	..	..	..	..	12	..	..	12	..	..	..	..	..	..	..	..	..	..
Canning Town	Holy Trinity Schools	34	33	33	34	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cardiff	Free Library	91	20	65	25	17	..	8	..	..	..	38	..	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Carharrack -	Literary Institution -	20	..	..	..	..	..	..	..	..	..	20	..	..	20	..	..	..	..	..	..	..	..	..	..
Chatham -	St. Mary's School -	57	57	57	57	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	St. Mark's, New Brompton -	37	37	37	37	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cheltenham -	School of Science - }	64	..	..	1	50	..	..	..	8	4	5	..	..	..	7	..	..	..	..	..	..	..	..	..
" -	Training College - }																								
" -	Whitworth School -	265	..	..	..	13	..	12	11	40	228	81	52	13	..	35	25	24	..	..	23	..	..	..	11
Chester -	Mechanics' Institution -	45	29	[illegible]	45	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chorley -	St. George's National School	15	15	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Church -	National School -	57	..	..	..	..	..	..	..	..	..	41	..	..	..	57	..	..	..	..	..	..	..	..	..
Coalbrookdale -	School of Art -	26	25	25	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Colne -	Grammar School -	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Compstall -	Athenæum -	25	25	25	26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Coventry -	St. Peter's National School -	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30
Cradley -	School-room -	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Creaton, Great -	National School -	10	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Crewe -	Mechanics' Institution -	31	25	30	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Croydon -	Literary Institution -	17	17	17	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Culham -	Training College -	25	..	..	..	13	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Darlington -	Mechanics' Institute -	19	..	..	..	4	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..
Dartford -	National School -	27	27	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dartmouth -	Mutual Improvement Soc. -	[illegible]	..	..	..	28	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	24	10	..	..
Darwen -	Mechanics' Institution -	9	..	..	..	..	..	..	..	..	7	8	..	..	..	8	..	..	..	..	..	..	..	..	..
Daventry -	Grammar School -	16	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Denton and Haughton. -	Mechanics' Institution -	[illegible]	8	8	8	1	..	8	1	6	..	..	..	..	..	..	..	..	..	1	..	..	..	..	8
Deptford -	St. Paul's Boys' School -	85	82	52	82	33	..	33	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Mechanics' Institution -	18	18	18	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Derby -	Grammar School -	10	..	..	..	..	..	..	..	..	..	10	..	..	..	10	..	..	..	..	..	..	..	..	..

Devonport	Mechanics' Institution	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8	8	..	..	..	..	..	..
Dewsbury	Mechanics' Institution	17	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..
Doncaster	The Guildhall	24	20	13	7	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Droylsden	Educational Institute	40	44	44	44	..	..	..	..	..	..	8	8	..	..	..	..	..	..	..	..	..	..	..	..
Dudley	Mechanics' Institution	60	..	18	..	..	..	..	..	..	..	16	..	..	..	35	..	..	..	..	..	..	..	..	..
"	Blue-coat School	50	..	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..	..	..	..	..
Dukinfield	Old Chapel Sunday School	31	31	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Moravian Boys' School	15	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Durham	Training College	18	..	..	..	11	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..
Eagley	Institute	20	..	..	..	..	..	..	..	..	..	7	..	..	..	14	..	..	..	..	..	..	..	..	9
Earlestown	Mutual Imp. Soc.	24	24	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Earls Barton	British School	52	..	..	..	..	..	..	..	..	52	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Eastington	National School	16	12	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Eastwood	Mechanics' Institution	9	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Elland	Science School, Southgate	46	20	..	..	..	..	..	..	18	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Eston	Parochial Institute	13	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..
Exeter	Albert Memorial Museum	34	..	..	..	14	..	..	..	..	..	8	..	15	..	4	..	9	9	..	..	..	..	..	..
Failsworth	Mechanics' Institution	20	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Farnworth	Grammar School	32	32	32	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" and Kersley.	Mechanics' Institution	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Flore	Endowed School-house	34	..	..	..	..	..	..	..	..	34	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Friezland	Christ Church Parochial Sch.	11	11	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Frome	School of Art	40	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gateshead	National Schools	101	17	51	8	10	..	7	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..
Glossop	Working Men's Institute	42	42	42	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gloucester	Blue-coat School	33	..	..	..	33	..	..	..	33	33	33	33	..	..	..	..	..	..	..	..	..	..	..	..
"	10, Eastgate Street	19	..	..	..	..	..	..	..	..	15	15	15	14	..	14	..	..	..	..	15	..	..	..	..
Gomersal	Mechanics' Institution	19	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..	..	..	..	..	..
Grantham	National School	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Greenwich	Girls' National School	27	27	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Halifax	Working Men's College	58	18	4	1	..	..	..	..	..	..	33	10	..	..	..	..	..	..	..	..	..	..	..	..
Halliwell	Dean Mills	20	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hampton	Commercial School	30	..	30	..	..	..	..	..	..	..	29	..	..	..	..	..	..	..	..	..	..	..	..	..
Haslingden	Institute	25	12	..	12	..	..	7	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..
Helston	Grammar School	20	..	..	..	..	..	..	..	..	..	20	..	..	20	..	..	..	..	..	20	..	..	..	..
Hetton	Colliery Schools	88	88	88	25	..	..	..	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Heywood	Mechanics' Institution	18	10	10	10	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..
Hingham	National School	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	22
Hollinwood	W. Men's Club and Inst.	12	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Holywell Green	Mechanics' Institution	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Hopwood	Methodist Free Church Sch.	7	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..
Huddersfield	Mechanics' Institution	60	29	29	29	..	..	..	..	..	..	31	9	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Hull -	Nautical Schools	79	..	..	..	34	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	75	68	30	29
Huntingdon	Walden's School	16	..	..	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..
Hurst	Mechanics' Institution	12	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hyde	Mechanics' Institution	50	18	22	18	..	..	4	..	6	7	12	..	..	..	8	..	..	..	..	..	..	..	..	4
Kendal	Post Office Yard Room	92	..	..	..	..	..	..	..	..	..	83	..	..	..	30	..	..	..	..	..	..	..	..	..
Kersley	British School	14	..	..	..	..	..	..	..	..	..	14	..	..	..	14	..	..	..	..	..	..	..	..	..
Kettering	National School	53	..	..	..	..	..	..	..	15	32	..	..	..	..	44	..	..	..	..	..	..	..	..	..
"	British School-room	36	..	..	..	..	..	..	..	36	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kidderminster	Mutual Improvement Soc.	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6
Kilburn	St. Mary's School	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kingsbridge	Town Hall	19	..	..	..	..	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..	..
Kinver	Mill Room	18	..	..	..	..	..	..	..	..	..	16	2	..	..	3	..	..	..	..	..	..	..	..	..
Lamport	Endowed School	53	..	..	..	..	..	..	..	..	53	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lancaster	Mechanics' Institution	80	..	..	..	..	..	..	..	..	..	49	..	30	..	76	..	..	..	..	..	..	..	..	..
"	School of Art	12	8	1	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Leeds	Mech. Inst. and Lit. Soc.	96	..	..	..	29	6	..	..	..	..	66	8	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Peter's National School	27	..	..	..	..	..	..	..	..	..	27	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Schoolmaster's Class	37	..	..	..	..	..	..	..	..	..	37	37	..	..	..	..	..	..	..	..	..	..	..	..
"	Young Men's Chr. Assoc.	36	..	..	..	..	..	..	..	..	..	36	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Working Men's Institute	17	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..
Lees -	Parish Church Schools	35	23	28	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Leicester	St. Martin's School	100	..	..	..	31	..	..	..	10	67	23	11	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Margaret's Nat. School	57	..	..	..	24	..	..	..	..	44	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Leighton Buzzard	Mutual Improvement Soc.	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	22
Lewes	School of Art	10	..	3	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lewisham	St. Mary's National School	19	9	9	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

[illegible]	[illegible] National School	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..
Lincoln	Training School	45	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	45
Liverpool	Free Library and College	130	..	20	..	..	..	28	..	40	51	61	..	..	..	20	15	..	..	..	..	..	..	31	..
"	Institute	150	..	..	..	102	..	..	..	..	..	130	..	..	..	..	15	..	..	..	..	5	..	..	15
Llanelly	Copper Works School	88	14	60	59	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	14	14	..
London:—																									
Battersea	St. John's College	80	..	..	..	80	..	..	..	..	..	..	..	..	..	56	..	..	..	..	..	..	..	..	40
"	Sir Walter St. John's School	90	..	..	..	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	90
"	Christ Church Schools	56	..	..	..	..	..	..	..	..	..	..	..	..	..	56	..	..	..	..	..	..	..	..	..
"	Working Men's Club	16	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..
Bermondsey	Christ Church Schools	12	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Working Men's Institute	17	17	4	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bethnal Green	Birkbeck Schools	132	..	..	..	..	..	..	..	89	83	..	..	..	..	117	81	..	..	..	..	..	..	..	..
"	National School	144	25	24	..	28	..	21	23	63	112	..	..	52	..	7	7	..	..	..	..	..	..	..	79
Brixton Hill	Working Men's Club	20	17	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chancery Lane	Birkbeck Lit. and Sci. Inst.	47	8	4	5	..	..	..	..	..	..	22	..	..	..	25	..	..	..	..	..	..	..	..	..
Chelsea	St. Mark's College	79	21	..	..	..	79	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Arthur Street	177	60	112	106	22	..	20	20	46	68	36	..	41	..	128	..	..	..	..	..	..	..	..	..
"	Royal Military Asylum	23	..	..	..	18	3	6	..	7	15	16	..	..	..	..	..	..	..	..	..	..	..	..	19
Dock Street	Sailors' Home	322	..	..	..	.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	322	322	..	..
Goswell Road	St. Barnabas' National School	27	27	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gray's-Inn Road	St. Jude's School	80	80	80	80	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Great Ormond St.	Working Men's College	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..
Hackney	St. Thomas' Square School	141	..	..	..	..	..	..	..	..	..	95	..	..	..	52	..	..	..	..	..	..	..	..	..
Islington, Lower	Public School	185	31	31	..	..	..	..	..	..	68	98	..	..	..	50	63	..	..	..	..	..	..	..	61
"	St. Silas' National School	20	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kennington	St. John's Middle Class School.	7	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..
Kentish Town	Gospel Oak School	87	..	..	..	..	..	..	..	..	..	..	..	..	..	87	..	..	..	..	..	..	..	..	..
Knightsbridge	Albert Working Men's Club	*..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lambeth	Boys' Sch., Hercules Bldngs.	209	88	150	150	..	..	..	..	..	..	..	..	97	..	..	..	..	..	..	..	..	..	..	168
"	School of Art	36	18	..	18	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..
Leadenhall Street	City of London College	46	..	..	..	9	..	..	..	..	..	37	..	..	..	..	..	..	..	..	..	..	..	..	..
Long Acre	Whitefield School-room	19	..	..	..	..	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..	..
Marylebone	Central Boys' School	86	..	30	30	..	..	..	..	..	..	..	..	56	..	33	..	..	..	..	..	..	..	..	..
"	Quebec Club	28	28	28	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nine Elms	Lecture Room	37	21	23	23	..	..	..	..	..	20	..	..	24	..	23	..	..	..	..	..	..	..	..	..
Notting Hill	Shaftesbury Hall	18	18	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Paddington	Greville House	46	47	46	48	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. James' School	35	..	..	..	..	..	..	..	..	..	..	..	.	..	..	..	..	..	..	..	..	..	..	35
Peckham	Upper and Middle Schools	181	..	..	..	181	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	181
Poplar	All Saints' National School	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Regent Street	Royal Polytechnic Inst.	55	..	..	..	..	..	..	..	13	19	28	..	..	..	11	..	..	..	..	10	..	..	..	..
South London	Working Mens' College	29	14	..	..	9	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..
Southwark	Boro' Road Training College }	159	..	..	..	89	..	43	..	..	..	89	..	..	..	70	..	..	..	..	..	..	..	..	89
"	Boys' Model School }																								

* Included in return for Arthur Street, Chelsea.

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
London—*cont.* Southwark - -	Swan Street Boys' National School.	24	24	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Wkg. Men's Club and Inst.	24	24	10	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stepney - -	Red-coat School - -	20	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Upper Berkeley Street, W.	Hampden Gurney Schools -	9	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..
Vauxhall - -	Baptist Chapel School-room	45	45	45	45	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Wandsworth Road - -	10	10	10	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wandsworth -	Royal Patriotic Fund Boys' School.	57	..	57	..	..	..	..	..	..	..	..	..	..	..	57	..	..	..	..	..	..	..	..	..
Waterloo Road -	St. John's Schools - -	88	61	48	64	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Westminster -	Wesleyan Training College -	94	..	..	..	85	..	..	..	..	..	82	..	..	..	..	..	..	..	..	..	..	..	..	94
" -	St. James the Less N. S. -	41	31	31	31	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..
Luddenden Foot -	Day School-room -	38	..	..	..	..	..	..	..	..	..	..	..	..	..	38	..	..	..	..	..	..	..	..	..
Macclesfield -	Modern Free School - -	43	..	..	..	..	..	..	..	..	..	43	..	..	..	..	..	..	..	..	..	..	..	..	..
Maldon - -	Mechanics' Institution -	15	..	..	..	..	..	..	..	7	7	..	..	..	..	11	..	..	..	..	..	..	..	..	..
Manchester - -	Mechanics' Institution -	240	179	179	179	20	20	20	20	60	60	110	..	1	..	110	..	2	..	1	50	..	..	10	60
" - -	Roby Society's School	12	9	8	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Corporation Street - -	40	..	..	..	..	..	..	..	..	..	40	32	..	..	..	..	..	..	..	..	..	..	..	..
" - -	St. George's National School	10	10	10	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Hulme Wkng. Men's Inst. -	38	20	20	..	..	..	..	..	..	..	9	9	..	..	6	..	13	..	..	..	..	..	..	..
Masham - -	Grammar School - -	10	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..
Melton Mowbray -	Church School-room -	10	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..
Middlesborough -	St. John's Schools - -	8	..	..	..	..	..	..	..	..	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..
Middleton - -	National School - -	35	..	..	..	..	..	..	..	..	..	10	..	..	..	20	..	12	..	..	..	..	..	..	..
Millwall - -	Presbyterian School - -	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Modbury - -	The Institution - -	33	..	..	..	..	..	..	..	..	..	..	..	..	..	33	..	..	..	..	..	..	..	..	..

Monk Wearmouth -	Colliery School - -	41	41	41	41	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Mossley - -	Mechanics' Institution -	23	20	23	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Muston -	Colliery School - -	58	58	58	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nailsworth -	National School-room -	8	..	..	..	..	..	..	..	..	..	..	..	8	..	7	4	..	..	..	..	..	..	..	..
Nelson-in-Marsden -	Lomeshaye Schools - -	25	..	..	..	14	..	..	..	23	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Newark - -	Mechanics' Institution -	21	..	..	..	..	..	..	..	18	..	10	..	..	..	7	..	..	..	..	..	..	..	..	..
Newcastle-on-Tyne -	Elswick Works Mechanics' and Literary Institute.	117	95	95	95	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Mechanics' Institute -	16	6	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
New Mills - -	News Room, Market Street	22	12	12	12	..	..	..	22	..	..	28	..	..	..	..	..	..	..	..	..	..	..	..	..
Newton - -	School-room - - -	21	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Newton Heath -	All Saints National School -	18	..	..	..	..	..	..	..	7	..	12	..	..	..	15	..	..	..	..	..	..	..	..	..
" -	Dixon Street - - -	12	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Northampton -	Museum and Town Hall -	181	..	..	..	..	..	..	..	124	175	..	..	..	..	..	..	..	..	..	..	..	..	..	..
North Ormesby -	Church Institute - -	5	..	..	..	..	..	..	..	..	5	5	..	..	..	..	..	..	..	..	..	..	..	..	..
Nottingham - -	Mechanics' Institution -	232	..	..	..	..	..	..	..	4	23	44	..	8	..	122	..	..	..	..	..	..	..	..	30
Oldbury - -	National School - -	68	..	..	..	..	..	..	..	..	..	..	..	45	..	68	..	..	..	..	..	..	..	..	..
" - -	Messrs. Chance's Institute -	76	..	..	..	..	..	..	..	..	..	..	..	..	..	76	..	..	..	..	..	..	..	..	..
Oldham - -	Science and Art School -	28	76	70	28	12	..	11	19	..	..	..	..	..	..	..	..	4	4	..	..	..	..	..	..
" - -	Glodwick Mut. Imp. Society	76	44	48	48	50	..	38	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Analytic Literary Institute	40	25	31	25	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Parish Church School -	24	..	15	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Openshaw - -	Ashbury Carriage Works -	29	29	29	29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Wesleyan Day School -	30	30	30	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Oxford - -	Town Hall - - -	17	..	..	..	..	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..
Padiham - -	National School - -	11	..	..	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Patricroft - -	Mechanics' Institution -	18	18	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pavenham - -	Church of England School -	19	..	..	..	..	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..	..
Pembroke Dock -	Mechanics' Institution -	15	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pendeen - -	National School - -	7	..	..	..	..	..	..	..	..	..	7	..	..	7	..	..	..	..	..	..	..	..	..	..
Pendleton - -	Mechanics' Institution -	19	..	15	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Pendleton Club - -	11	11	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Penzance - -	School of Science and Art -	28	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Peterborough -	St. Peter's College -	37	..	..	..	..	..	..	..	..	..	..	..	..	..	23	..	..	..	..	..	..	..	..	14
Plumstead - -	Burrage Road School -	85	69	69	68	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..
Plymouth - -	Courtenay Street - -	141	14	5	20	38	4	7	7	15	18	26	6	..	..	5	8	16	16	..	..	..	..	14	9
" - -	Buckwell Street - -	9	..	..	..	..	..	..	..	..	4	7	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Navigation School - -	241	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	241	230	..	..
" - -	Charles National School -	74	..	30	17	..	..	..	..	39	..	..	..	..	..	..	..	..	..	..	..	..	..	..	22
Portland - -	The Grove School - -	23	..	..	..	8	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Preston - -	Institution, Avenham -	79	32	32	32	10	..	5	..	12	9	34	11	9	..	7	..	..	..	..	..	..	..	..	..
Ramsbottom -	Public Institute - -	9	9	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Rawmarsh	Free Church School-room	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rawtenstall	Mechanics' Institution	41	41	41	41	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Irwell Institution	12	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Redditch	Literary and Scientific Inst.	40	..	..	..	..	..	..	..	..	..	40	..	..	..	..	..	..	..	..	..	..	..	..	..
Redruth	The Institution	54	..	..	..	..	..	..	..	..	..	41	..	..	26	14	..	..	..	..	..	..	..	..	..
Riddings	Mutual Improvement Assoc.	28	16	..	..	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	..	..	..	..	..
Rochdale	British Schools	114	97	97	97	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..
Royton	St. Paul's National School	43	43	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rumworth	Sunnyside Institute	15	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Saddleworth	Mechanics' Institution	17	17	17	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
St. Helen's	Commercial School	20	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..
St. Just	The Institution	8	..	..	..	..	..	..	..	..	..	7	..	..	7	..	..	..	..	..	..	..	..	..	..
Salford	Working Men's College	80	56	34	22	..	..	..	..	..	..	10	10	..	..	2	..	2	2	..	..	..	..	..	16
"	The Egerton Schools	34	..	..	..	..	..	..	..	..	..	34	..	..	..	..	..	..	..	..	..	..	..	..	..
Saltaire	Literary Institute	24	..	..	..	..	..	..	..	..	14	23	..	..	..	..	..	..	..	..	..	..	..	..	..
Saltley	Training College	66	12	..	..	66	..	..	..	..	..	..	..	..	..	66	..	..	..	..	..	..	..	..	66
Scarborough	Mechanics' Institution	18	..	..	..	6	..	..	..	..	..	..	..	3	..	2	..	..	..	..	..	2	..	..	2
Seaham	Colliery School	33	33	33	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Seaton Delaval	Colliery School	54	54	54	29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Shaw	National School	26	26	25	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sheffield	Christian and Educa. Inst.	15	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Paul's School	23	..	..	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. George's School	4	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Church Institute	35	..	..	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Shrewsbury	School of Art	4	4	3	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Slough	Mechanics' Institution	58	58	36	36	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Southampton	The Hartley Institution	146	..	5	..	6	..	..	..	80	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..
Southminster	National School	22	..	..	..	..	..	..	..	15	22	..	..	..	..	20	..	..	..	..	..	..	..	..	..

Southport -	Athenæum - - -	14	14	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
South Shields -	Mechanics' Inst. and Jarrow Chemical Company's Wks.	112	..	48	48	29	..	..	..	..	..	41	..	..	..	..	..	..	..	..	..	..	..	..	..
Southwick -	Working Men's Reading Rm.	10	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stainland -	Independent School - -	9	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..
Stalybridge -	Mechanics' Institution -	19	19	19	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stockport -	Mechanics' Institution -	54	20	20	20	..	..	..	..	26	6	6	..	8	..	5	..	..	..	..	..	..	..	..	23
" -	Sunday Sch. Imprvemnt. Soc.	34	21	21	8	..	..	..	..	..	..	10	..	..	19	..	..	..	..	..	..	..	..	..	..
Stonehouse -	The Institute - - -	4	..	..	..	..	..	..	..	..	..	..	..	4	..	4	..	..	..	..	..	..	..	..	..
Stourbridge -	Grammar School - -	16	..	..	..	..	..	..	..	..	..	16	..	..	..	8	..	..	..	..	..	..	..	..	..
Stratford -	Working Men's Hall -	58	54	58	58	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stroud -	The Institute - - -	80	..	..	..	..	..	..	..	..	..	25	..	36	..	8	..	..	21	..	..	..	..	..	..
Swansea -	Royal Institution of South Wales and Oxford Street National School.	92	..	..	..	57	..	8	8	6	6	29	..	..	..	..	..	..	..	..	..	..	..	..	..
Tavistock -	British School - -	81	..	..	..	7	..	..	..	8	21	27	1	..	..	66	..	..	..	..	..	..	..	..	..
" -	Gulworthy School - -	68	..	14	..	..	..	..	..	45	..	..	..	..	..	5	..	..	..	..	..	..	..	10	43
" -	National School - -	63	..	..	..	..	..	..	..	..	..	43	..	..	..	..	..	..	..	..	..	..	..	..	36
" -	St. Mary Tavy National Sch.	14	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..
" -	School of Art - - -	15	10	4	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tebworth -	Wesleyan School - -	11	..	..	..	..	..	..	..	..	8	9	..	..	..	..	..	..	..	..	..	..	..	..	..
Thorne -	Brooke's Grammar School -	23	10	7	9	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Thorpe -	St. Matthew's Boys' School -	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8
Toddington -	National School - -	2	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..
Torquay -	School of Science and Art -	90	..	..	..	..	..	..	..	10	85	..	..	..	..	13	..	..	..	..	..	..	..	..	..
Towcester -	National Schools -	50	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Truro -	British Schools - -	17	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	17
" -	Royal Institution - -	24	..	..	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..
Turton -	Chapel Town Institute -	26	26	26	26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tyldesley -	Mechanics' Institution -	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ulverstone -	Temperance Hall - -	9	..	..	..	6	..	..	..	..	..	..	..	..	..	5	..	..	..	..	..	..	..	..	..
Wakefield -	Holy Trinity Y. M. Soc. -	18	..	..	..	..	..	..	..	..	12	18	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Mechanics' Institution (Schoolmaster's Class).	31	..	..	..	..	..	..	..	..	..	31	..	..	..	..	..	..	..	..	..	..	..	..	..
Warrington -	Museum and Free Library -	26	..	..	..	..	..	..	..	..	..	26	..	..	..	..	..	..	..	..	..	..	..	..	..
Weedon -	Girls' School - - -	42	..	..	..	..	..	..	..	..	42	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wellingborough -	Lower Grammar School -	52	..	..	..	..	..	..	..	9	26	..	..	..	..	33	..	..	..	..	..	..	..	..	..
Werneth -	Mechanics' Institution -	34	34	34	34	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
West Bromwich -	St. Peter's Schools - -	20	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	12
Westbury-on-Trym -	Girls' National School -	36	36	36	36	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
West Gorton -	St. Mark's National School -	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	25
Whaleybridge -	Mechanics' Institution -	12	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Whitworth - -	Literary Institution - -	24	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wigan - -	Town Hall - - -	91	34	34	..	..	..	..	..	..	..	44	..	20	..	..	..	..	..	43	10	..	..	..	..
Wilsden - -	Mechanics' Institution -	11	..	..	..	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..
Windsor - -	Mechanics' Institution -	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wisbech - -	Working Men's Institute -	40	..	..	..	..	..	..	..	..	14	..	..	..	..	30	..	..	..	..	..	..	..	..	..
Woking - -	St. John's School - -	53	..	..	..	..	..	..	..	..	..	30	..	1	..	44	..	..	..	..	..	..	..	..	33
Wollaston - -	Church of England Schools -	18	..	..	..	..	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..
Wolverhampton -	Athenæum Class - -	17	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	St. Peter's School - -	64	..	..	..	14	..	14	..	14	..	..	..	..	..	50	14	..	..	..	..	..	..	..	20
" -	St. Luke's School - -	14	..	..	..	6	..	4	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	St. John's " - -	18	..	..	..	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	16
Wolverton - -	Science and Art Institute -	83	24	26	..	36	..	36	36	58	52	44	..	..	..	30	..	..	..	..	..	..	..	..	..
Woodville - -	National School - -	13	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..
Woolwich - -	Royal Arsenal Sci. Classes -	171	74	74	78	40	14	14	..	..	26	69	..	..	..	..	..	..	..	..	14	..	..	..	..
" - -	National School - -	55	31	45	45	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	St. Thomas' School - -	107	54	54	55	35	..	35	..	6	13	18	..	..	..	..	..	..	..	..	18	..	..	..	..
" - -	Presbyterian District School	125	29	40	40	..	..	..	..	..	..	56	..	111	..	..	..	..	..	..	..	..	..	..	48
" - -	St. Michael's School - -	34	34	34	34	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Rectory Place School -	21	21	21	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	13, Dundas Terrace - -	21	..	..	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	27
Worcester - -	Guildhall - - - } School of Art - - - }	104	24	38	24	..	..	..	..	2	7	15	..	27	..	46	..	..	..	..	15	..	..	..	..
" - -	Workmen's Hall, &c. -	73	..	..	..	..	..	..	..	8	..	..	..	..	..	57	..	..	..	..	..	..	..	..	61
Yarmouth, Great -	Navigation School - -	98	..	..	..	6	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	80	36	..	..
York - - -	The Institute - - -	51	..	..	..	15	..	15	..	..	..	28	..	8	..	..	..	..	..	..	..	..	..	..	10
" - - -	Blue-coat School - -	20	..	..	..	4	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	20
" - - -	Training College - -	16	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9

	[illegible] Institution	[illegible]	28	7	..	53	..	20	4	..	..	32	..	..	..	..	..	24	7	..	4	..	..	..	..
„	Navigation School	298	..	..	..	76	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	246	211	..	..
Aboyne	Parish School-room	22	..	..	..	..	..	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Alexandria	Mechanics' Institution	90	..	48	..	17	..	..	..	..	..	48	..	..	..	..	..	..	..	..	..	..	..	..	..
Banchory	Lady Burnett's School	17	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Banton	Banton School	17	17	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Beith	New Street School	24	..	..	..	10	..	1	..	17	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..
Brechin	School-room	31	14	..	..	13	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..
Corsock	Girls' School	12	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..	8	..	..	..	..	..	..	..
Cults	School-room	13	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cupar	Madras Academy	49	..	..	..	38	..	..	..	7	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..
Dalry	Blair Iron Works School	19	..	19	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dumbarton	Burgh Academy	114	..	18	..	66	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	74
Dundee	High School	90	90	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Edinburgh	Free Church Training College	49	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	36
„	Watt Institution	377	..	..	..	159	..	141	..	..	..	146	..	..	..	..	..	..	..	..	..	..	..	..	..
Glasgow	Secular School	113	17	17	..	..	..	..	..	..	..	18	..	..	..	94	50	..	..	..	18	..	..	..	50
„	Anderson's University	1013	..	..	..	22	..	22	22	..	276	516	..	..	..	266	..	108	108	..	..	..	..	..	..
„	Mechanics' Institution	500	..	45	..	..	..	50	16	..	..	40	..	..	..	..	..	..	..	..	..	..	..	16	..
„	Established Church Normal School.	74	..	..	..	..	..	..	..	..	..	74	..	..	..	..	..	..	..	..	..	..	..	..	..
„	East End Schools	107	..	..	..	..	..	..	..	..	..	..	..	..	..	107	..	..	..	..	..	..	..	..	..
Inverness	School of Science and Art	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kilmarnock	Fould's Street	127	65	65	..	51	..	..	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	New Academy	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	50
Kirkwall	Grammar School	53	10	..	..	38	3	25	..	..	..	..	..	..	..	..	..	..	..	..	..	3	..	..	21
Leith	Navigation School	289	..	..	..	116	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	175	168	79	..
Newhills	Stoneywood School-room	30	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Perth	School of Art	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rutherglen	Free Church School	22	22	7	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stirling	Science and Art School	18	18	5	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tarbat	Parochial School	41	..	..	..	27	..	..	..	..	..	..	..	35	..	29	26	..	..	..	..	24	..	..	24

* Includes the School of Art.

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
						IRELAND.																			
Anahilt	Endowed Free School	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	19	..	..	..
Antrim	Male National School Main Street ,,	78	..	..	..	10	..	..	..	30	30	..	..	16	..	40	..	..	..	..	..	..	..	..	12
Athlone	St. Mary's Parochial School	50	..	..	..	..	..	..	..	18	16	..	..	46	..	46	..	..	..	..	..	..	..	..	..
,,	Ranelagh School	36	..	..	..	30	..	19	..	30	29	..	..	..	..	..	..	..	..	..	..	22	12	..	36
Bagenalstown	School-room	52	9	..	..	30	9	9	..	9	52	9	..	..	..	..	..	..	..	..	..	9	9	..	9
Bailieboro'	Model School	125	..	..	..	..	..	..	..	..	125	..	..	..	..	..	..	..	..	..	..	..	..	..	125
Ballybay	National School	16	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballyblack	School-room	13	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballycarry	National School	16	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15	..	..	..
Ballykinlar	National School	79	..	..	..	..	..	..	..	79	79	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballymena	Model School	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	28
,,	Guy's National School	28	..	..	..	..	..	..	..	28	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballymoney	Town Hall	39	..	..	..	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	38
Ballynahinch	Town Hall	29	..	..	..	..	..	..	..	29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	National School	12	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10
Ballywalter	Park School	56	..	..	..	..	..	..	..	..	56	..	..	56	..	..	..	..	..	..	..	..	..	..	..
Ballywilly	National School	23	..	..	..	13	..	..	..	20	23	..	..	..	..	..	..	..	..	..	..	..	..	..	60
Banbridge	Scarva Street National Sch.	19	..	..	..	6	..	..	..	8	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bangor	Endowed School	25	..	..	..	..	..	..	..	25	22	..	..	..	..	25	..	..	..	..	..	..	..	..	..
Belfast	Fisherwick Place School	76	..	..	..	30	..	7	..	9	12	..	..	..	..	..	..	..	..	..	..	..	..	..	52
,,	Milford Street National Sch.	11	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	Cromac Street	17	..	..	..	15	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	May Street National School	21	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..	14
,,	Union Place National School	25	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	70, Albert Bridge Road	9	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	Conway Street National School.	25	..	..	..	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

"	Model School	122	29	29	29	..	..	..	..	93	93	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Academy St., No. 1, Nat. Sch.	29	..	..	..	..	..	..	..	27	29	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	" No. 2, "	14	..	..	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..
"	Smithfield National School	15	..	..	..	12	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Glentilt Place	10	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..
"	Brown Street National Sch.	80	..	..	..	..	..	..	..	..	80	..	..	..	..	..	..	..	..	..	..	..	..	..	61
"	Nelson Street "	14	..	..	..	6	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	People's Literary Institute	117	27	27	27	65	..	10	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bessbrook	School-house	12	..	..	..	12	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Braidwater	National School	12	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Brookfield	Agricultural School	23	..	..	..	..	..	..	..	..	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Broughshane	National School	32	..	..	..	..	..	..	..	32	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Caledon	School-house	17	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Carlow	Christian Schools	29	29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Carrickfergus	Model School	50	..	..	..	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16	7	..	51
Carrowdore	National School	53	..	..	..	..	..	..	..	..	50	..	..	53	..	..	..	..	..	..	..	..	..	..	45
Castlederg	Edwards' School, &c.	25	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Castlefin	National School	6	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Clohanbeg	National School	7	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Clonakilty	National School	8	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cloncore	National School	8	..	..	..	8	..	..	..	8	7	..	..	..	..	..	..	..	..	..	..	..	..	..	8
Coleraine	Model School	28	..	..	..	24	..	..	..	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Comber	Smyth's National School	27	..	..	..	..	..	..	..	..	..	..	..	..	..	27	..	..	..	..	..	..	..	..	..
"	No. 1, National School	42	..	..	..	..	..	..	..	..	42	..	..	..	..	..	..	..	..	..	..	..	..	..	13
"	Lisbarnet National School	23	..	..	..	..	..	..	..	..	..	..	..	23	..	..	..	..	..	..	..	..	..	..	..
Cooraclare	National School	71	..	..	..	44	..	..	..	43	..	..	..	..	..	..	..	..	..	..	..	..	..	..	59
Cork	District Model School	61	..	..	..	19	..	14	..	21	..	..	..	..	..	..	27	..	..	..	..	..	..	..	24
"	Carmichael Schools	78	..	..	..	43	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	62
Cormeen	National School	31	..	..	..	..	..	..	..	..	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Crebilly	National School	5	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dartreyhouse	National School	35	..	..	..	6	..	..	..	35	35	..	..	..	..	..	30	..	..	..	..	..	..	..	35
Derrylin	National School	11	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Donaghadee	National School-house	16	..	..	..	9	..	..	..	16	13	..	..	..	..	16	..	..	..	..	..	..	..	..	..
Donegal	National School	12	..	..	..	12	..	9	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11
Donoughmore	Presbyterian Lecture Room	14	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Downpatrick	Young Men's Chr. Assoc.	23	..	..	..	..	..	..	..	23	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	John Street National School	53	..	..	..	23	..	..	..	52	52	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Drogheda	St. Mary's National School	31	..	..	..	18	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..
Drumlough	National School	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Dublin	Central Model School	213	36	19	21	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	178
"	King's Hospital School	44	..	..	..	44	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	22	..	..	44
Dundalk	Free Library	90	27	45	16	60	10	32	1	28	29	39	10	14	..	8	..	3	3	..	6	38	..	3	46
"	Quay Street School																								
"	Educational Institute																								
"	Jocelyn Street School																								

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Dungannon -	Erasmus Smith's School -	29	1	1	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	23
Eglish -	National School -	20	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Enniscorthy -	Model School -	32	..	..	..	18	..	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..	14
Enniskillen -	Town Hall -	16	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Model School -	30	..	..	..	..	..	..	..	39	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Galgorm -	National School -	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	24
Galway -	Model School -	51	..	..	..	..	..	..	..	40	33	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gilford -	National School -	49	..	..	..	..	..	..	..	..	49	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Greyabbey -	National School -	49	..	..	..	35	..	..	..	..	44	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Holywood -	Sullivan's Schools & Academy	117	..	..	..	10	..	7	..	20	78	..	..	..	..	65	..	..	..	..	..	..	..	..	64
Irvinestown -	National School -	16	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16
Kilkenny -	Model School -	44	..	..	..	7	..	..	..	..	44	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Killylea -	School-house -	43	..	..	..	..	..	..	..	..	43	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kilmore -	Kilmore School -	18	..	..	..	17	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..	17
Kircubbin -	National School -	14	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Larne -	Model Agricultural School -	30	..	..	..	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	27	..	..	..
" -	North End National School	42	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	42	..	..	..
Letterkenny -	National School -	34	..	..	..	34	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ligoniel -	Wolfhill Mill -	27	..	..	..	..	..	..	..	12	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lisbellaw -	National School -	8	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16
Lisded -	National School -	16	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lisnagry -	Ahane National School -	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Londonderry -	District Model School -	41	..	..	..	..	..	..	..	..	41	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Lough Cutra	National School	4	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Loughgall	School-room	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Lurgan	National School Mechanics' Institute Model School	104	..	..	..	29	..	..	..	..	101	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Magherally	National School	10	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Manorhamilton	Mutual Improvement Assoc. Rooms.	30	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Market-hill	Coolmalish National School	18	..	..	..	10	..	..	..	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Monaghan	Model School	102	..	..	..	74	..	..	..	..	89	..	..	..	..	..	..	..	..	..	..	..	..	..	42
Newry	Model School	16	..	14	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Newtownards	Model School	148	..	..	..	69	..	..	..	110	74	..	..	..	..	..	139	..	..	..	..	..	..	..	..
"	East Street National School	31	..	..	..	..	..	..	..	..	29	..	..	31	..	..	..	..	..	..	..	..	..	..	..
Newtownbreda	National School	29	..	..	..	..	..	..	..	..	29	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Oldcastle	Endowed School	201	..	..	..	47	..	..	..	..	105	..	..	..	..	..	..	..	..	..	..	..	..	..	96
Omagh	Model School	46	..	..	..	46	..	1	..	43	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Parsonstown	Model School	25	..	..	..	19	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	6	..	..	24
Portadown	Town Hall	30	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	30
"	Edenderry National School	18	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Raphoe	National School	6	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Court House	7	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rathfryland	Town Hall	17	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Roscrea	National School	34	..	..	..	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	32
Rosscarbery	Mount Fachnanus Nat Sch.	40	..	..	..	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Santry	Training School	91	16	16	16	32	14	14	..	25	25	14	..	..	..	..	..	..	25	..	..	14	14	..	25
Scariff	National School	38	..	..	..	20	..	..	..	34	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sixmilecross	National School	21	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stewartstown	School-room	24	..	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..	24
Tandragee	Duke's School	19	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Trim	Model School	96	34	..	..	..	..	..	..	..	50	..	..	..	..	46	..	..	..	..	..	..	..	..	..
Tullynamullen	National School	11	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Waterford	Model School	34	..	..	..	..	..	..	..	..	..	..	..	34	..	..	..	..	..	..	..	..	..	..	..
" "	Newtown School Leper Hospital	43	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	43	..	..	..	..	..	..	..
	Total Number of Classes	1,494	173	173	137	146	10	54	21	85	136	152	23	39	8	124	16	17	13	6	14	23	12	10	102
	" " Students	24,865	5,106	5,305	4,070	3942	162	1017	387	2204	4754	4702	386	1043	145	3995	559	292	219	82	222	1452	1110	221	3658

525 Schools.

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LONDON:
Printed by GEORGE E. EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty.
For Her Majesty's Stationery Office.
[8515.—3000.—2/70.]

SCIENCE AND ART DEPARTMENT
OF THE COMMITTEE OF COUNCIL ON EDUCATION,
SOUTH KENSINGTON.

DIRECTORY,

(*Revised to August* 1870.)

22nd EDITION.

WITH

REGULATIONS

FOR

ESTABLISHING AND CONDUCTING

SCIENCE SCHOOLS & CLASSES.

THE RULES IN THE PRESENT EDITION SUPERSEDE THOSE IN ALL FORMER EDITIONS, BUT ARE ALWAYS SUBJECT TO REVISION.

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PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.

SOLD BY CHAPMAN AND HALL,
193 PICCADILLY, LONDON.

1870.

Price Sixpence.

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OF THE COMMITTEE OF COUNCIL ON EDUCATION,
SOUTH KENSINGTON.

ESTABLISHED in connexion with the Board of Trade in March 1853 as a development of the Department of Practical Art, which in 1852 had been created for the re-organization of the Schools of Design. Placed under the direction of the Committee of Council on Education in 1856.

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INTRODUCTION.

The following introduction gives a general outline of the action of the Department, and has been prepared to enable those who wish to establish a Science School or Class the more readily to understand the detailed rules and regulations under which the aid of the Department is administered.

1. In order to place a Science school or class in connexion with the Science and Art Department, an approved committee, consisting of at least five well-known and responsible persons must be formed. (*See* Science Directory, §§ X. to XVI., pp. 4 to 6.) **Local committees.**

2. The list of Science subjects towards instruction in which aid is given by the Department will be found at p. 3. **Subjects of instruction.**

3. The aid is given in the form of—Public examinations, in which Queen's Medals and Queen's Prizes are awarded, held at all places complying with certain conditions; payments on results as tested by these examinations; scholarships and exhibitions; building grants; grants towards the purchase of apparatus, &c. **Nature of aid.**

4. The Examinations are held about the month of May under the superintendence of the local committees. The examination papers are prepared by the professional examiners in London. An evening is set apart for one or more subjects, so that the examination in each subject is simultaneous over the whole kingdom. (*See* Science Directory, § XVIII., p. 7.) **Examinations, when and how held.**

5. A packet of Examination papers is sent to each local secretary, who opens it in the presence of the committee and candidates. The committee is held responsible that no unfair means of any description are used in working the papers, and that the rules of the Department are strictly complied with. (*See* Science Directory, § XXII., p. 8, and Appendix A., Science Form No. 91, p. 42.) **Examination papers how sent and worked.**

Class examinations.

6. The examinations are of two kinds, but held together (*See* Science Directory, § XVIII., p. 7), viz.:

a. The class-examinations, of which there are two grades or stages; the first stage or elementary examination, and the second stage or advanced examination. The successful candidates in both stages are divided into 1st and 2nd class.

For Honours.

b. The honours examination of a highly advanced character. In this there are also two classes.

Any person however taught may sit at any one of these examinations. (*See* Science Directory, § XXIX., p. 10.)

Medals.

7. Four medals, one gold, one silver, and two bronze, are given in each subject in competition in the class examinations among the students. (*See* Science Directory, § XXXII., p. 11.)

Prizes.

8. Queen's prizes consisting of books or instruments are also given to all candidates successful in obtaining a first class in either stage of the class examinations. (*See* Science Directory, § XXX., p. 11.)

Payments on Results.

9. Payments are made either to the Committees or to the Teachers on the results of the May examination.

Amount and conditions of payment.

10. These payments are made only on account of the instruction of students of the industrial classes, or on account of the instruction of their children. (For a definition of the Industrial Classes *see* Science Directory, § XXXVI., p. 13.) They are—2*l.* for a first class, and 1*l.* for a second class, in each stage. (*See* Science Directory, §§ XXXVII. and XXXVIII., p. 14.) *Special payments are also made for Chemistry* (*See* §§ XXXIX. and LXIII.), and in certain cases also for "honours." The teacher must have given each student 25 lessons at least. (*See* Science Directory, § XXXV., p. 13.)

Qualification.

11. Any person may qualify himself or herself to earn payments on results, by obtaining a first or second class in the advanced grade of the class examination, or by taking honours.

This examination is dispensed with when the candidate has taken a degree at one of the Universities of the United Kingdom. (*See* Science Directory, § XXXIV., p. 13.)

12. To assist in the instruction of deserving students, aid is given in the creation of two forms of scholarship in connexion with elementary schools. **Scholarships.**

a. In the *Elementary School Scholarship* 5*l.* are granted to the managers of any elementary school for the support of a deserving pupil selected by competition, if they undertake to support him for a year and subscribe 5*l.* for that purpose. The payment of 5*l.* by the Science and Art Department is conditional on the scholar passing in some branch of science at the next May examination. (*See* Science Directory, §§ XLVI. and XLVIII., pp. 18 and 19.) **Elementary school scholarship.**

b. In the *Science and Art Scholarship*, which is of a more advanced character, a similar contribution of 5*l.* is required on the part of the locality, and a grant of 10*l.* is made by the Department towards the maintenance, for one year, of the most deserving pupil or pupils in elementary schools who have passed certain examinations in science and in drawing. (*See* Science Directory, §§ XLVI. and XLIX., pp. 18 and 19.) **Science and Art scholarship.**

In both these cases the scholar must be from 12 to 16 years of age, and one scholarship is allowed per 100 pupils in the school. Thus a school with 50 pupils may have one scholarship, a school with 150 pupils two scholarships.

13. There are also two forms of Exhibitions. These are :— **Exhibitions.**

a. *Local Exhibitions* to enable students to complete their education at some college or school where scientific instruction of an advanced character may be obtained. Grants of 25*l.* per annum, for one, two, or three years are made for this purpose when the locality raises a like sum by voluntary subscriptions. And **Local exhibition.**

if the student attend a State school, such as the Royal School of Mines in London, the Royal College of Chemistry in London, or Royal College of Science in Ireland, the fees are remitted. The exhibition must be awarded in competition. (*See* Science Directory, §§ XLVII. and LI., pp. 19 and 20.)

Royal exhibition.

b. Royal Exhibitions of the value of 50*l.* per annum tenable for three years, to the Royal School of Mines, London, and the Royal College of Science, Dublin, are given in competition at the May examinations. Six are awarded each year—three to each institution. Free admissions are also given to all gold medallists. (*See* Science Directory, §§ LII. and LIII., pp. 21 and 22.)

Whitworth Scholarships.

14. Besides these, the *Whitworth Scholarships* of the value of 100*l.* per annum, tenable for three years, are also given in competition at the May examinations. (*See* Science Directory, § LIV., p. 23.)

Building grant.

15. A grant in aid of a new building, or for the adaptation of an existing building, for a School of Science may be made at a rate not exceeding 2*s.* 6*d.* per square foot of internal area, up to a maximum of 500*l.* for any one school, provided that certain conditions are complied with and that the school be built under the Public Libraries and Museums Act, or be built in connexion with a School of Art, aided by a Department building grant. (*See* Science Directory, § LV., p. 23.)

Apparatus grant.

Grant for apparatus in a laboratory.

16. A grant towards the purchase of apparatus, diagrams, &c., of 50 per cent. of the cost of them is made to Science Schools. (*See* Science Directory, §§ LVI. to LXII., pp. 24 to 26.) *And where a school is furnished with a laboratory, properly fitted up, a payment of* 1*l.* *is made towards the expenses of each student who during the year receives* 25 *lessons in laboratory practice.* (*See* Science Directory, § LXIII.)

SCIENCE DIRECTORY,

Revised to August 1870.

Showing the NATURE and AMOUNT of ASSISTANCE afforded by and through the SCIENCE AND ART DEPARTMENT to INSTRUCTION in SCIENCE.

[**The Rules in the present Edition supersede those in all former Editions, but are always subject to Revision.** ***Important Alterations made since the last edition of the Directory are printed in Italics.***]

SCIENCE DIRECTORY,

Containing the Detailed Rules and Regulations under which Aid to Science Schools and Classes is administered.

Parliamentary vote.

I. A sum of money is voted annually by Parliament for scientific instruction in the United Kingdom, and is administered by the Science and Art Department.

Heads of the Department.

II. The head of the Education Department, of which the Science and Art Department is a branch, is the Lord President of the Council, assisted by a member of the Privy Council, who is called the Vice-President of the Committee on Education, and who acts under the direction of the Lord President, and for him in his absence. (Order in Council, 25th February 1856, Act 19 & 20 Vict. c. 116.)

Object of the grant.

III. The object of the grant is to promote instruction in Science especially among the industrial classes, by affording a limited and partial aid or stimulus towards the founding and maintenance of Science schools and classes.

Grant liable to be withdrawn.

IV. The amount is liable to be decreased and eventually withdrawn. Payments to teachers therefore must not be looked upon as perpetual, or in any way conferring on the teacher a claim to any payments beyond those offered from time to time.

Payment of Fees by Students.

V. The payment of fees by the students can be looked upon as the only solid and sufficient basis on which a self-supporting system can be established and supported. Though my Lords do not consider it necessary at present to lay down any rules making the payment of fees an absolute condition of the grants on account of Science instruction, yet as the payments from the State must be expected to diminish, and as aid on account of those persons who do nothing for themselves cannot be justified, Committees of schools and classes and teachers are strongly urged (should it at present not be the prac-

tice) at once to impose as high a scale of fees as they consider can be raised not only on middle class students but also on artisans.

VI. The following are the Sciences towards instruction in which aid is given:— List of Science subjects.

Subject 1, Practical Plane and Solid Geometry.
„ 2, Machine Construction and Drawing.
„ 3, Building Construction *or* Naval Architecture and Drawing.
„ 4, } Pure Mathematics.
„ 5, }
„ 6, Theoretical Mechanics.
„ 7, Applied Mechanics.
„ 8, Acoustics, Light, and Heat.
„ 9, Magnetism and Electricity.
„ 10, Inorganic Chemistry.
„ 11, Organic Chemistry.
„ 12, Geology.
„ 13, Mineralogy.
„ 14, Animal Physiology.
„ 15, Zoology.*
„ 16, Vegetable Anatomy and Physiology.
„ 17, Systematic and Economic Botany.
„ 18, Principles of Mining.
„ 19, Metallurgy.
„ 20, Navigation.
„ 21, Nautical Astronomy.
„ 22, Steam.
„ 23, Physical Geography.

NOTE.—*The nature of the aid given towards instruction in Art is fully explained in the* Art Directory. *The 2nd Grade examination in Art is held at the same time as in the Sciences above named.* (*See* § XVIII.)

VII. The assistance granted by the Science and Art Department is in the form of— Nature of assistance.

1. Public examinations, in which Queen's Medals and Queen's Prizes are awarded, held at all places complying with certain conditions.

* No candidate will be passed in Zoology unless at the same or at a previous examination he has passed in the elementary stage of Animal Physiology. (See *Appendix B.*, p. 109.)

2. Payments on results to Committees or teachers.
3. Scholarships and Exhibitions.
4. Building Grants.
5. Grants towards the purchase of apparatus, &c.
6. Supplementary grants in certain subjects, and special aid to teachers and students.

NOTE.—As respects all grants and awards, the Department is the sole judge, and cannot enter into correspondence respecting its decisions.

School Premises.

VIII. Suitable premises, both for the class instruction and also for the examination, with firing, lighting, &c., must be found and maintained at the cost of the locality where the school or class is held. If at any time the funds do not cover these requisite local expenses, it must be inferred that there is no such demand for instruction in the locality as the Government is justified in aiding; and the assistance of the Department will be withdrawn.

IX. A school or class receiving aid from the Science and Art Department must be at all times open to the visit and inspection of its officers.

LOCAL COMMITTEES.

Constitution of Local Committee.

X. Every Science School or Class must be under the management of a Local Committee who are required to be responsible for the safe custody of all apparatus, towards the purchase of which the Department has granted aid, and to conduct the examinations according to the rules. (*See* Appendix A., Science Form No. 91, p. 42.)

The relation of the teacher to the Committee of a school or class will vary much according to the circumstances of different localities. With this and other local arrangements the Science and Art Department does not interfere, but leaves them to the locality to settle.

a. The Committee must consist of a Chairman, Secretary, and at least three other members, and must be composed entirely of well-known responsible persons of independent position who have no such personal interest in the school or class as can lay them open to the slightest suspicion of partiality. Relations and pupils of the

Teacher, persons wishing to be examined, or who are under instruction in any school or class receiving aid from the Science and Art Department, and teachers of any description having pupils who are candidates for the examinations of the Department, are not eligible as members of the Committee.

NOTE.—A gentleman whose son or daughter attends any examination of the Science and Art Department is thereby disqualified from superintending any of the examinations that year, though he may act on the Committee in other respects.

b. It is very desirable that as many persons as possible in recognised positions of public responsibility in the district, such as magistrates, municipal authorities (mayor, aldermen, or town councillors), heads of educational establishments (trustees of grammar schools, managers of National schools), clergymen, &c., should be on the Committee, and it is *absolutely necessary* that at least two such responsible persons should agree to act.

c. The Chairman must be a magistrate, mayor, boroughreeve, provost, alderman, or other public officer of recognised position; trustee of grammar school, clergyman of the Established Church in parochial employment, or minister of religion in charge of a licensed place of public worship. He will have to certify that the constitution of the Committee is in accordance with the above requirements. (*See* Appendix A., Science and Art Form No. 88, p. 33.)

d. The Secretary of the Committee of the School or Class, as being the medium of communication, will carry on all correspondence with the Science and Art Department, and will be held responsible for making out and sending all returns required, for the receipt and distribution of the examination papers, the transmission of the worked papers, &c., at the proper times according to the regulations.

Formation of Local Committee.

XI. The gentlemen who intend to act on this Committee must sign their names to a form (*write for* Science Forms Nos. 88 and 120), stating their willingness to carry out the necessary arrangements for examinations, and to observe all the regulations of the Department; each member after signing must also give his address and occupation. Care must be taken that the members who sign are properly acquainted with the duties they propose to discharge.

When a school or class is first formed, the Form No. 88 must be signed at a general meeting of the Committee. If the same Committee continue to act it will only be necessary in October to fill up Form No. 168, which expresses the willingness of the members to undertake their duties for

another year; but no one can be a member of a Committee nor assist in the conduct of an examination who has not signed Form No. 88.

Approval of, by the Department.

XII. As soon as a school or class has been established and the Committee formed, application must be made that it may be approved by the Department (*send up* Science Forms Nos. 88 and 120). No payments on account of instruction will be made unless this approval has been obtained before the 31st January preceding the examination.

N.B.—The school and class registers (see § XLII., p. 17) will not be sent until these forms, properly filled up, have been received from the school applying for them.

Committee for conducting an examination only.

XIII. A Committee may be formed for conducting the examination only of a class or school which does not receive aid from the Department in the form of payments on results. It must be approved before the 31st March (*write for* Science Form No. 88*a*).

Reimbursement of Committee.

XIV. For the clerical labour of making the necessary returns, filling up forms, &c., a grant is made to the Committee of 1*l*. This is paid after the conclusion of the examinations.

When more than two examinations are held, the sum of 10*s*. will be allowed to the Committee—or in the case of an amalgamation (*see* § XXVI., p. 9), to the amalgamated Committee—for each further examination for the expenses connected with it.

These grants will only be made provided the examinations are regularly conducted, and the returns and forms sent up in due course, as given on the Science Form No. 170. (See *Appendix A*., *p*. 32.)

Inspection.

XV. As often as may be necessary an Inspector of the Department will visit the school or class, and report on the condition of the premises, the constitution of the Committee, and the manner in which the regulations are carried out.

If due notice of the visit of the Inspector has been given, a meeting of the Committee must be held to receive him, at which as many of the members as possible are expected to attend. (*See* Science Form No. 170, *Appendix A*., p. 32.)

Memoranda for Secretaries.

XVI. At page 32 in the Appendix will be found a table of memoranda for the use of Secretaries and

Members of Science Committees (*write for* Science Form No. 170) which it is expected will be carefully attended to.

EXAMINATIONS.

XVII. The Science and Art Department holds annually about May, through the agency of the Local Committees, public examinations in all the beforementioned Sciences and in Art in any place in the United Kingdom which complies with the requisite conditions. (*See* §§ X. to XIII., pp. 5 and 6.) On the results of this examination payments are made for the instruction of the students, and medals and prizes are awarded. **Examination of Classes.**

For Navigation Classes special examinations are also held three times a year. (*See* § LXIV., p. 26.)

XVIII. The examinations are of two kinds, but are held on the same evening and conducted by the same Committee:— **Examinations, how held.**

a. The class examinations for students under instruction in Science Classes whether taught by teachers qualified to earn payments on results or not.

b. The honours examination, of a highly advanced character.

The 2nd grade Art examination in Freehand Drawing, Model Drawing, Practical Geometry and Perspective, is held at the same time of the year as the Science examinations. That in Freehand Drawing and Model Drawing is held on a separate evening, but that in Geometry and Perspective on the same evenings as the examination in Science Subject I., Practical, Plane, and Solid Geometry (see § VI., *p.* 3, *and Art Directory*).

XIX. The examinations in the subjects and stages bracketed together are held on the same evening; candidates can therefore be examined in one only of these subjects or stages in any one year.

II. Machine Drawing.
III. Building Construction.
XV. Zoology.

XII. Geology.
XX. Navigation.

XIII. Mineralogy.
XXI. Nautical Astronomy.

XI. Organic Chemistry.
XXII. Steam.

XVI. Vegetable Anatomy and Physiology.
XIX. Metallurgy.

XVIII. Principles of Mining.
IV. and V. Mathematics. { *Stage* 6. *Stage* 7. }

IV. and V. Mathematics. { *Stage* 1. *Stage* 2. *Stage* 3. }

IV. and V. Mathematics. { *Stage* 4. *Stage* 5. }

Classification of Results of examinations. XX. For the purpose of the class examinations each subject is divided into two stages—the elementary and the advanced stage; except Mathematics, which is divided into seven stages (*see* Syllabus, p. 51). There is a different examination paper for each stage, and in each stage there are two grades of success—first and second class. For the second or lowest class of the elementary stage, the standard of attainment required is only such as will justify the Examiner in reporting that the instruction has been sound, and that the students have benefited by it; but the standard may be raised from year to year.

Honours paper. XXI. There is an honours paper in each subject, except Mathematics, which for this purpose may be considered as divided into three subjects, an honours paper being set on each evening for the whole of the stages comprised in that evening's examination.

Application for Examination. XXII. An application, stating in what subjects examination will be required, must be made on Science Form, No. 329, and sent in before the 28th of February. A second form (Science Form No. 119) must be sent in before the 31st of March, giving the precise number of candidates to be examined in each subject.

On the 31st of March the examination lists must be finally closed, and unless these instructions have

been *strictly* adhered to no examination can be held.

The rules for the conduct of the examinations will be found on Science Form No. 91 (*see* Appendix A., p. 42). They must be carried out with the utmost strictness.

XXIII. Should there be at any time reason to suspect the fairness of the examination generally, or of the way in which particular candidates have worked their papers, a further examination will take place in such manner as may be deemed most advisable. Refusal on the part of any candidate to be re-examined will entail the cancelling of his previous examination. **Re-examination.**

XXIV. All possible care will be taken by the Department at the time of the examinations that papers shall be forwarded in accordance with the applications, and that the results may be correctly issued. As, however, a very large number of classes have to be dealt with, mistakes may possibly occur. The Department cannot undertake to rectify such mistakes, nor will it hold itself responsible for any loss which may in consequence accrue to individual committees, teachers, or students. **Department not responsible for errors.**

XXV. If no candidate comes forward for examination in one of the subjects for which examination papers have been sent, the envelope containing these papers must be returned *unopened* by the next post. Also, if two sets of examination papers in the same subject have been sent, one set must be returned unopened. This rule must be carefully attended to. **Return of unrequired examination papers.**

XXVI. If two or more classes in the same town, or within a reasonable distance of one another, apply for the examination of the Science and Art Department, a general examination committee must be formed by the amalgamation of the several Committees to carry out the examinations at some common centre, such as the town hall or other public building. It is only when the Inspector reports that the local circumstances are of such a character as to render an amalgamation of the Committees impracticable that it will not be insisted on. **Amalgamation of Classes and Committees.**

When there are not more than three candidates in one place, it will be at the discretion of the Department to allow a separate examination, or to require the candidates to go to a neighbouring centre.

Special Local Secretary.

XXVII. In large towns or populous districts where there are three or more schools, and where numerous examinations are to be held, the Science and Art Department *may at its discretion require* a Special Local Secretary to be appointed to manage the whole of the examination business. The Department will correspond with him alone on all subjects connected with the examination. He will be allowed a fee of ten guineas, and an extra fee of half a guinea for each night that an examination is held.

The rule requiring an amalgamated examination to be held in some one public building (*see* § XXVI.) will be adhered to also in this case. Even where no sufficiently large public building can be obtained, or where there may be other insuperable difficulties to holding the examinations at one centre, the one Special Local Secretary must still be the one medium of communication with the Department, and will be responsible for all arrangements subject to the approval of the Science and Art Department.

Election of Special Local Secretary.

XXVIII. When the Department has directed the appointment of a Special Local Secretary, his election will rest with the Local Committees; or failing their coming to an agreement he will be nominated by the Mayor or other principal municipal authority.

The Special Local Secretary must be nominated for the approval of the Science and Art Department from year to year, before the 15th of March.

Examination of external Students.

XXIX. Besides the registered students of a class, any other person may present himself for examination before the Local Committee whenever an examination is being held for the class. Before the 26th of March he must apply to a Local Secretary, who will forward his name to the Department on Science Form No. 119, and if required by the Local Committee he will have to pay a registration fee of not more than 2*s*. 6*d*. Arrangements must therefore be made by the Local Committee, or the General Exa-

mination Committee, as the case may be, to give accommodation at the examination to all outside candidates who have given the proper notice, as well as to the students in the class for which the Committee act, to sit at the examination.

The registration fee of 2*s.* 6*d.*, which such candidates may be required to pay, is to reimburse the Committee for any extra expenses incurred by such attendance, and may at their option be reduced or remitted.

XXX. To all successful students are given printed lists of results showing their position; to the first class in each stage are given Queen's prizes, consisting of books or instruments chosen by the candidates from lists furnished for that purpose. (*Apply for* Science Form No. 110.) **Queen's Prizes.**

No Queen's prize or medal will be given to a student in the advanced stage unless he have previously passed in the elementary stage, or been successful under the old system.

XXXI. The prizes are unlimited in number, and are open to all candidates who come within either of the following categories:— **Candidates eligible for Prizes.**

(1) Students in Science Classes under Teachers qualified to earn payment.

(2) Registered Students in Artisan Classes taught by other Teachers.

The following are not eligible for prizes:—

a. Students who have previously received the same, or a higher class, in the same subject; and

b. Teachers earning or who have earned payments on the results of instruction. Also

c. Persons who are or have been students of the Queen's Colleges in Ireland, the Royal School of Mines, London, the Royal College of Science, Dublin, the Royal Dockyard Schools, and other institutions receiving State aid for instruction. They may, however, compete for the Whitworth and other Exhibitions and Scholarships of the Department, but they cannot take Queen's prizes and medals, except in those subjects which are not taught as a portion of the regular course in the Institutions to which they belong.

XXXII. Four medals, one gold, one silver, and two bronze, are given in the class examination in each **Queen's Medals.**

subject for competition among the bonâ fide students of Science Classes who either come within the category of persons on account of whom payments can be earned, or are under 17 years of age.

Only registered students of schools and classes under Local Committees (*see* § X., p. 4) can take medals: middle class students, persons engaged in teaching, as well as teachers in training, who are more than 17 years of age, even if qualified as above, are ineligible for them. Should a student take more than one gold, silver, or bronze medal, he will receive books instead.

When the best candidates for Queen's medals are nearly equal, five or six of them, as may be found desirable, may be summoned to London for further examination in order to decide to whom the different medals shall be awarded. Their travelling expenses, second class railway fare, and 10*s. a day while required to be absent from home, will be allowed.*

Payments on Results and Qualification of Teacher.

Qualification for earning payments on results.

XXXIII. Payments are made on the results of instruction when it has been given by teachers who have qualified in either of the categories mentioned below: And no payments are made on account of instruction given in subjects in which the teacher is not so qualified.

The qualification consists in having—

a. obtained a teacher's certificate in any of the before-mentioned sciences according to the rules in force previous to January 1867; or,

b. obtained a First or Second Class in the advanced stage at the May class examinations since that date; or,

c. taken honours at the May examinations.

In Mathematics a First Class in each stage will qualify the holder to earn payments on the results of instruction in that stage, or in the preceding stages, and Honours in stages 3, 5, and 7, on the results of instruction in the preceding stages.

Teachers already qualified to earn payments in "Elementary Mathematics" (1869) are qualified in stages 1, 2, and 3, and teachers already qualified in "Higher Mathematics" (1869) are qualified in all the stages of Pure Mathematics.

Payments are made at the discretion of the Department either directly to teachers or to the Committee or managers of the school. **Payments to whom made.**

XXXIV. The examination for qualification to earn payments on the results of instruction will be dispensed with in the case of a candidate who has taken a degree at any University of the United Kingdom, or who has obtained the Associateship of the Royal School of Mines, London, or the Royal College of Science, Ireland. **Honorary and 3rd grade Art Certificates.**

Before such a candidate commences to teach, in order to earn payments on results, he must make formal application to the Department to be recognised as a Science teacher, and he must furnish full particulars of his occupation and position accompanied by his diploma or a certificate from the registrar of his University.

Teachers who previously to the 28th January 1869 have obtained Art certificates of the third grade are also qualified without further examination to earn payments on the results of their instruction in subjects I., II., and III., under the same rules and on the same conditions precisely as Science teachers. It must be clearly understood that to claim these payments the rules of the **Science Directory** must be adhered to.

XXXV. Payments are only made on condition that the student has received 25 lessons at least from the teacher or teachers in each subject in which payment is claimed since his last examination—each lesson being an attendance at a meeting of the school of at least three-quarters of an hour's duration on a separate day. The 25 lessons need not necessarily be all given in one year, but may extend over a longer period. **Conditions.**

It must be clearly understood that the number (25) of lessons which the teacher is required to give is the minimum fixed as a criterion that the pupil has received his instruction from the teacher. It is not meant in any way to specify that that amount of instruction is sufficient, or to guarantee the teacher's receiving payment, if that amount of instruction alone is given.

XXXVI. Payments are made to the qualified teacher on account of the instruction of students of the Industrial Classes only. **Payments made for instruction of Industrial Classes.**

Definition of Industrial Classes.

Under "Students of the Industrial Classes" are included:—

a. Artisans or operatives in the receipt of weekly wages.

b. Coastguards, policemen, and others who, though in receipt of weekly wages, do not support themselves by manual labour.

c. *Teachers of elementary schools in connexion with the Education Department, Whitehall, or the National Board of Education, Ireland.*

d. Persons in the receipt of salaries not large enough to render them liable to the income tax, as some descriptions of clerks, shopmen, &c.

e. Small shopkeepers employing no one but members of their own family and not assessed to the income tax.

f. Tradesmen and manufacturers on their own account, supporting themselves by their own manual labour, not employing apprentices, journeymen, &c., and not assessed to the income tax.

g. The children (not gaining their own livelihood) of all such persons above mentioned.

And no payments are made on account of any other students.

Instruction in Institutions receiving State aid.

XXXVII. No payments on the results of instruction in those branches of Science which are taught in Institutions receiving State Grants, such as the Queen's Colleges in Ireland, the Royal School of Mines, London, the Royal College of Science, Dublin, and the Royal Dockyard Schools, will be made on account of the pupils who are or have been students of those institutions.

No payments are made on account of students passing in Stage 1 of Mathematics *or in the elementary stage of Subject XXIII., Physical Geography*, who are,—

a. Students in Training Colleges receiving State aid.

b. Teachers trained at the public expense.

Payments claimable on the results of the Class Examinations.

XXXVIII. The payments claimable for each student who has passed in either stage, in each subject are—2*l.* for a first class, and 1*l.* for a second class. Also 10*s.* for each second grade Art paper satisfactorily worked.

No payments are made on account of a student who has been previously successful in a higher stage of the same subject. If the student has been previously successful in the same stage of the same subject, the payment on his account is reduced by the payment which was claimable on such previous success.*

For instance, the 2*l.* payment for a first class would, if the student had previously taken a second class in the same stage, be reduced by 1*l.*

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* The deduction on account of a pupil's previous success in the examination of May 1869 or some previous year, when there were three classes in the elementary stage, will be made according to the following scale :

a. For a first class in the elementary stage—the student having previously obtained a third class—1*l.* 10*s.*

b. For a first class—the pupil having previously obtained a second class—1*l.*

c. For a second class—the pupil having previously obtained a third class—10*s.*

As respects Mathematics (Subjects IV. and V.) the arrangements with regard to the previous successes of students will be understood from the following table. The corresponding divisions of the subject under the old and new systems are given in the columns A. and B. With a previous success, therefore, as given in column A., no payment will be made on account of the corresponding success at the May 1870 examination, as given in column B.

A.	B.
ELEMENTARY MATHEMATICS, IV.	PURE MATHEMATICS.
3rd Class, First Stage - -	Stage 1.
2nd " " - -	do. and 2nd Class of Stage 2.
1st " " - -	do. and Stage 2.
2nd " Second Stage - -	Stages 1 and 2.
1st " " - -	do. do. and 2nd Class of Stage 3.
HIGHER MATHEMATICS, V.	
3rd Class, First Stage - -	Stages 1, 2, and 3.
2nd " " - -	do. do. and 2nd Class in Stage 5.
1st " " - -	do. do. and 2nd Class in Stage 6.
2nd " Second Stage - -	Stages 1, 2, 3, and 6, and 2nd Class in Stage 5.
1st " " - -	do. 1, 2, 3, 5, 6, and 2nd Class in Stage 7.

Deductions are also made in payments on account of Subject I. to the amount of any payments that have been made on the Second Grade Examinations in Art, in Practical Geometry, Perspective or Mechanical Drawing.

Special payments for Chemistry.

XXXIX. In Chemistry special extra payments will be made on account of students who show a good knowledge of laboratory practice. These payments will be 10*s. and* 1*l. extra on the second and first class respectively in both the Elementary and the Advanced Stage. They will be claimable according to the same rules and subject to the same deductions on account of previous success as the ordinary payments.*

A payment of 1*l. is also made towards the expenses of a student for the study of practical chemistry in a school laboratory* (*see* § LXIII., page 26).

Payments claimable on the results of the Honours Examinations.

XL. On each student who passes in the First or Second class in Honours 4*l.* and 2*l.* respectively are claimable, provided the student has already passed through the elementary and advanced stages after instruction in a Science Class in connexion with the Department.

Form of Claim for Payment.

XLI. The claim for the payments must be made on Science Form No. 51, or on Art Form No. 525, as the case may be. The voucher must be signed by the secretary or chairman and two members of the Committee at least, at a meeting of the Committee held specially for the examination and certification of the claim. (*See* Science Form No. 51, Appendix A., page 39. N.B.—Many details with regard to payments will be understood from the cases given in this form.)

Teachers' travelling expenses.

Special grants for travelling expenses of teacher will be made, for one year as an experiment, but only where it is shown that there is a local organization for a general system of Science instruction in an outlying district of villages or small towns where local teachers cannot be obtained, and where it is clearly of advantage to have the services of a highly qualified teacher resident in the district.

Each case will be considered on its merits. A special application must be made before the com-

mencement of the session explaining the exact circumstances of the case, and giving an estimate of the travelling expenses, second-class railway fare, &c. The Department will then decide what amount shall be allowed. This will be in the form of a certain allowance per journey on the production of the necessary vouchers and the satisfactory proof that fair work has been done.

It must be clearly understood that this gives no claim for travelling expenses generally, and no case will be considered unless the application has been received at the commencement of the session and sanctioned by the Department.

Registers.

XLII. A general register must be kept for the school, and an attendance register for each class in each subject, on Forms which will be supplied on application. (*Apply for* Science Forms Nos. 139 and 139A.) These registers must be made up from day to day, and will be examined and approved by the Inspector on his visit. They must be sent to the Department with the claim for payment, and no grants will be made unless the registers are properly kept.

a. The Committee must keep a General Register (Science Form No. 139) of all the pupils attending the Science Classes under their supervision, in which the name, age, address, and occupation of each student must be entered. This register must be filled in by the Secretary or a member of the Committee, and not by the teacher.

b. For every class the teacher must keep a register of attendance (Science Form No. 139A), in which he will enter the presence or absence of the students at each lesson. The Committee is held responsible for the entries being correct.

c. A register must also be kept of the attendance of the members of the Committee at their different meetings. (*See* page 8 of Science Form No. 139.)

Instruction in an Elementary School.

XLIII. All payments on account of Science teaching are made by the Science and Art Department. They are only made in respect of a school in connexion with the Department which has been approved by it, and which is open at any time to the visit and inspection of its officers. No such payments are made in respect of any instruction in Science that

may be given during the three attendances of an Elementary School receiving aid from the Educational Department, Whitehall.

Use of Elementary School premises.

The managers of an Elementary School under the inspection of the Education Department can permit their premises to be used for Science teaching, provided that no interference be allowed with the primary purposes of such Elementary School, or in any way with the three attendances of the Elementary School.

Examination by the Inspector.

XLIV. On the occasion of his periodical visit to the school or class, the Inspector will inquire and see how the instruction is being given, examining the pupils, if necessary, *vivâ voce*, and report if there is sufficient apparatus for the satisfactory teaching of experimental science. If the Inspector's report of any school shows that the instruction is inefficient, and that from the deficiency of proper apparatus, &c. it cannot be otherwise, the Science and Art Department may refuse to make payments on the results of the examinations.

Scholarships and Exhibitions.

Scholarships and Exhibitions.

XLV. Grants are made to aid local efforts in founding scholarships and exhibitions. The scholarship is intended to maintain the student while remaining at a day school, and the exhibition to support him while pursuing his studies at some central institution where the instruction is of a high grade.

Local Scholarships.

XLVI. There are two forms of local scholarship in connexion with elementary schools :—

(1.) The Elementary School Scholarship;
(2.) The Science and Art Scholarship.

By elementary school is understood any school where elementary instruction is given, whether aided by the State or not.

XLVII. For the encouragement of advanced scientific instruction, there are two kinds of exhibitions: Exhibitions.

(1.) The Local Exhibition.
(2.) The Royal Exhibition.

XLVIII. *Elementary School Scholarship.*—A grant of 5*l.* is made towards the maintenance of a deserving student to the managers of any elementary school who undertake to support him for one year and subscribe at least 5*l.* for that purpose. Elementary School Scholarships.

Conditions.—

Conditions of obtaining the Elementary School Scholarships.

a. With any number of scholars up to 100 on the register of the school there can be but one such Scholarship; above 100 and up to 200 two Scholarships, and so on for each 100.

b. The Scholarship or Scholarships must be awarded in competition to the most successful student or students in some examination of the school. The absolute terms of the competition and the award of the Scholarship will be left to the managers of the school, subject to the approval of the Science and Art Department.

c. The scholar must be a student of the industrial class, as defined above (see § XXXVI., p. 13), and be between 12 and 16 years of age.

d. He must not be the teacher, pupil-teacher, or other paid servant of a school.

e. He must continue regularly to attend a day school, and—

f. Obtain at least a second class in the elementary stage in some one or more branches of Science at the succeeding May examination of the Science and Art Department, after which the Department grant of 5*l.* will be paid.

Application must be made for the Elementary School Scholarships before the 1st March in one year, and the Department grant will be paid after the May examination in the next year. (*Apply for* Science Forms Nos. 280, 281, 282.) Date of application and of grant.

XLIX. *The Science and Art Scholarship.*—A grant of 10*l.* is made towards the maintenance of a student at a day school who has taken a first grade in Freehand or Model Drawing and Elementary Geometry (*see* Art Directory, p. 16), and passed in one of the subjects of Science, provided that the managers of the school undertake to support him for one year and subscribe 5*l.* for that purpose. Science and Art Scholarship.

Where there is no Art Certificated Teacher the examination in drawing can be held by the Science Class Committee, to whom the necessary papers will be sent.

Conditions of obtaining the Science and Art Scholarship.

Conditions.—

a. With any number of scholars up to 100 on the register of the school there can be but one such Scholarship; above 100 and up to 200 two Scholarships, and so on for each 100 scholars.

b. The Scholarship or Scholarships will be awarded to the most successful student or students in the school.

c. The scholar must be a student of the industrial class, as defined above (*see* § XXXVI., p. 13), and be between 12 and 16 years of age.

d. He must not be the holder of an Elementary School Scholarship, the teacher, pupil-teacher, or other paid servant of a school.

e. He must continue regularly to attend a day school, and—

f. Obtain a higher class in the subject of Science in which he has already passed, or pass in some other subject.

g. In each year of holding the Scholarship he must pass either in a higher grade of the same subject or in a new subject.

Date of application and of grant.

Application for the Science and Art Scholarship must be made before the 1st March in one year; the successful competitors for the scholarship will be decided at the May examinations of that year, and the Department grant of 10*l.* will be paid after the May examination in the next year. (*Apply for* Science Forms Nos. 283, 284, 285.)

Renewal of grants for Scholarships.

L. It rests with the local managers of the scholarships—whether "Elementary School" or "Science and Art"—to determine for how many years the student may hold the scholarship, but in no case can he be allowed to hold it for more than three years.

Should the Managers wish the holder of the scholarship to pursue his studies at another school, the Department will be prepared to entertain an application for the continuance of the payment of the 5l. or 10l., provided the other conditions are still complied with, and all the circumstances reported to the Department.

Local Exhibition.

LI. *Local Exhibitions.*—The Science and Art Department will make a grant of 25*l.* per annum to the Managers of any school or educational institution, or any Local Committee formed for the purpose, who will raise the like sum by voluntary contribution for the maintenance of a student at some

college or school where a thorough course of scientific instruction of an advanced character may be obtained. The exhibition may last for one, two, or three years.

Conditions.—

a. The exhibition must be awarded in competition in one or more branches of Science at the May examination of the Science and Art Department. The managers may select any branch or branches of Science for the competition, and if more than one be taken they may fix any relative amount of marks they consider best to assign to them. Conditions of obtaining it.

b. The place or places where the exhibition is to be tenable and where the student is to pursue his studies may be fixed by the managers subject to the approval of the Science and Art Department, provided that the exhibitioner shall always have the option of going to one of the following institutions:—The Royal School of Mines or Royal College of Chemistry, London, or the Royal College of Science, Dublin. If either of these Government institutions be selected, the fees of the student will be remitted.

c. The exhibitioner must be a student of the industrial class, as defined above (*see* § XXXVI., p. 13).

d. The grant of the Department will be paid from year to year on condition that a like payment has been made by the managers or Local Committee, and that the student has pursued his studies satisfactorily according to regulations fixed by the Department.

The Local Exhibition must be applied for before the 1st March. (*Write for* Science Forms Nos. 286, 287, 288.) Date of application.

Thus, for example, a Local Exhibition which is to be competed for in May 1875 must be applied for before the 1st March 1875, and the Department grant will be given after the May examinations in 1876.

LII. *Royal Exhibitions,* of the value of 50*l.* per annum tenable for three years, to the Royal School of Mines, London, and the Royal College of Science, Dublin, are given in competition at the May examinations. Royal Exhibitions.

There are nine Royal Exhibitions to the Royal School of Mines, Jermyn Street, and nine to the Royal College of Science, Dublin. They are of the value of 50*l.* per annum each, and are tenable for three years. Three Exhibitions to each Institution Competition for and conditions of holding them.

are therefore generally vacated each year. They are competed for at the May examinations, and are held from year to year for three years, on the condition that the holder attends the lectures regularly during those years, and passes the examinations required for the associateship of the school. The Exhibitions entitle the holders to free admissions to all the lectures, and to the Chemical and Metallurgical Laboratories at those two institutions.

Persons not eligible for them.

All persons over 21 years of age, excepting artisans, and such as come within the category of persons paid upon under § XXXVI. p. 13, will be excluded from competing for the Royal Exhibitions. Special cases, however, must be determined according to the spirit of the rules, and the object of the endowment. *Candidates should register their names as competitors for Royal Exhibitions, and send in Science Form No.* 400 *before* 25*th May.*

Calculation of results in the competition for Royal Exhibitions.

LIII. The competition for the Royal Exhibitions will be determined as follows:—

The maximum number of marks obtainable in each subject, except Mathematics, will be in the

Elementary stage	-	100
Advanced stage -	-	200
Honours - -	-	400

In Mathematics the numbers will be in the

1st stage		100	
2nd	,,	200	
3rd	,,	300	Honours 500
4th	,,	150	
5th	,,	300	Honours 500
6th	,,	200	
7th	,,	400	Honours 600

But in each case the number of marks gained in the Elementary Stage (or in the 1st stage in Mathematics) will be diminished by the minimum number required to pass in that stage, and the number of marks gained in each of the other stages will be diminished by 20 per cent. of the marks obtainable in that stage.

The remainder will then be added together to determine the candidate's position.

But no candidate will be allowed to take an Exhibition who has not obtained in Mathematics at least as many marks as are required for a second class in the second stage.

LIV. *Sir Joseph Whitworth's* scholarships of the value of 100*l.* per annum, tenable for three years, are also given in competition at the May examinations. *Candidates for Whitworth Scholarships should register their names as competitors, and send in Science Form No.* 400 *before the* 25*th May.* **Whitworth Scholarships.**

Full instructions as to the subjects, time, place, conditions, &c. of the competition for these scholarships are given in the **Whitworth Prospectus,** which can be had on application to the Secretary, Science and Art Department.

Building Grants.

LV. A grant in aid of a new building, or for the adaptation of an existing building, for a School of Science may be made at a rate not exceeding 2*s.* 6*d.* per square foot of internal area, up to a maximum of 500*l.* for any one school, provided that the school— **Grants in aid of building Science Schools.**

a. be built under the Public Libraries Act (13 & 14 Vict. c. 65.; 18 & 19 Vict. c. 70.; 29 & 30 Vict. c. 114.), (*see* Summary of the Law relating to the establishment and maintenance of Public Libraries, &c., *Appendix A.*, p. 47); or—

b. be built in connexion with a School of Art aided by a Department building grant.

And provided that there is a population in the neighbourhood which requires a School of Science; that it is likely to be maintained in a state of efficiency; and that the site, plans, estimates, specifications, title, and trust deeds are satisfactory.

The regulations under which building grants to Schools of Science are made will be found in Appendix A., p. 49. (*Apply for* Science Form No. 349.)

Apparatus Grants.

Grants for apparatus.

LVI. A grant towards the purchase of apparatus, diagrams, &c., of 50 per cent. on the cost of them, is made to Science Schools and Classes taught by duly qualified teachers under the supervision of Committees constituted in accordance with the § X., p. 4, and approved by the Department.

If at any time it is found that the apparatus, examples, &c., towards the purchase of which a grant has been made are not properly taken care of, the aid of the Department may be withdrawn.

Grants on the same scale will also be made to schools or classes not under qualified teachers in cases where the total value of the apparatus required is not above 10*l.*

Disposal of apparatus on closing of school.

LVII. When schools or classes are closed and reported by their Committees as not likely to be reopened again, on application being made to the Science and Art Department, permission may be given for the disposal of the apparatus in their charge, towards the purchase of which aid has been given, in one of the following ways:—

1. By transfer to the Committee of some other Science School or Class, willing to accept the apparatus on the usual conditions.
2. When the apparatus has been used at least two years in the School, by its becoming the absolute property of the Committee of the school on their repaying to the Science and Art Department 50 per cent. of the amount contributed by it to the purchase of the apparatus.

Apparatus grants will only be made on the condition that Committees will transfer the apparatus, on the closing of the school, when another Committee is found willing to purchase it, and offers terms approved by the Science and Art Department.

Grants of apparatus to endowed ⁻ ⁻ols.

LVIII. As a general rule no endowed school is eligible to receive a grant towards the purchase of apparatus, &c., unless considerable local contributions

are made in aid of it; and then only when the apparatus is clearly necessary.

LIX. Catalogues containing priced lists of apparatus, instruments, diagrams, books, &c. from various manufacturers have been prepared in the following sciences and can be had on application :— Catalogues of apparatus.

(1.) Practical Geometry, Machine and Building Construction, and Mechanics.
(2.) Experimental Physics.
(3.) Chemistry.
(4.) Geology and Mineralogy, Natural History, (Physiology, Zoology, and Botany), and Physical Geography.

These catalogues contain the highest price of each article on which the aid of 50 per cent. is given. The applicant is at liberty to select a higher priced article, but the aid towards the purchase of it will be only 50 per cent. of the highest price above mentioned. Should a lower priced article be selected the aid will only be to the extent of 50 per cent. of its price.

Schools are also permitted to select a single copy of each of the text books given in the Syllabus, towards the purchase of which similar aid will be granted.

LX. Committees requiring aid in the purchase of apparatus, &c. should apply for Science Form No. 49, and also for the catalogues referred to above. Method of obtaining grants.

The Committee of the School or class may select any of the manufacturers whose names are given in the catalogues.

Orders from different tradesmen must be made on separate forms.

In filling up the Form No. 49, the number of the apparatus given in the catalogue must always be mentioned.

LXI. Payments, including charge for packing, must be made in advance to the manufacturers on receipt of the invoice. The goods to be sent at the risk of the purchaser. On obtaining a receipt from the Committee of the School (which is included in the form of Requisition) that the articles have been received, the remaining 50 per cent. will be paid to the manufacturer by the Department. Payments to manufacturers.

Limitation of grants.

LXII. Except as provided in the next paragraph, apparatus grants are rigorously confined to articles of a non-destructible nature; hence no aid will be afforded in the purchase of breakable articles, such as glass retorts, tests tubes, &c., nor, indeed generally, in the purchase of articles to be used by the student, as distinguished from those of a permanent and illustrative character which are required by the Teacher in giving instruction in Science.

Grants are only made in the purchase of one object of the same kind. Duplicates of apparatus, &c. are not allowed at the reduced rate.

Grants in aid of students' expenses.

LXIII. A grant of 1*l. is made towards the expenses of a student in the laboratory for a year, on condition that—*

a. The School is reported to be furnished with a laboratory sufficient for the purpose and fitted up with all the apparatus given in the official list. (See Science Form No. 402, *Appendix A., p.* 45.)

b. That the student, for whom the payment is claimed, receives at least 25 *lessons of not less than one hour and a half each in laboratory practice.*

c. And, that he passes in the Elementary or in the Advanced Stage of Inorganic or Organic Chemistry.

The 1*l. payment may only be claimed twice, i.e., in two separate years, on account of the same student.*

Where two students use the same set of apparatus (see Science Form No. 402, *Appendix A., p.* 45), *the payments made on their account towards its cost will be* 15*s. each, provided the other conditions given above are complied with.*

Schools wishing to take advantage of this regulation must send in Science Form No. 420 *before the* 15*th December of each year.*

Supplementary Grants in certain Subjects, and Special Aid to Teachers and Students.

Navigation Schools.

LXIV. In addition to the ordinary science examinations in May, class examinations are held in Mathematics, Navigation, Nautical Astronomy,

Steam, and Physical Geography for the benefit of seafaring men—and for them only—three times a year in all seaports where Local Committees are formed and are willing to undertake them. These examinations take place in the beginning of March, September, and December. The application for these examinations must be made on Science Form No. 119 before the 10th day of the previous month.

These examinations are only allowed when there are at least 40 candidates for examination, and in such subjects and stages only in which there are 40 candidates in the United Kingdom.

The payments to properly qualified teachers (*see* § XXXIII., p. 12) on the results of the quarterly examinations for seamen, will be according to the same scale as that laid down for the ordinary May examinations (*see* § XXXVIII., p. 14), and the regulations with regard to Committees (*see* §§ X. to XVI., pp. 4 to 6), registers (*see* § XLII., p. 17), and number of lessons (*see* § XXXV., p. 13), must also be carried out in the case of Navigation Schools.

LXV. Teachers qualified to earn payments on results in Subject I., Practical, Plane, and Solid Geometry, are qualified to earn payments on results in the Art examinations of the 2nd Grade in Practical Geometry and Perspective. (*See* Art Directory, pp. 16 and 24.) Special teachers' qualifications.

The 2nd Grade Art Examination in Practical Geometry and Perspective will be held at the same time as the Science Examination in Subject I. The course in the Art subjects may be considered as a preliminary stage to that in the Science subject.

LXVI. In order to encourage the artistic ability which may be shown in drawings of buildings and machines executed by students in Science classes as exercises in Subjects II. and III., grants are made to the Local Committee of the School similar to those for works executed in Art schools or classes, provided the teacher is qualified in accordance with § XXXIII. (*see* p. 12), to earn payments on the results in Subjects II. and III. The grants are as follows, viz.:— Extra grants in Subjects II. and III.

a. A payment not exceeding 15*s.* for any one student, on account of every artisan student who shall submit satisfactory works executed in the school or class during the then current school year.

(1.) In Mechanical and Machine drawing; and,

(2.) In drawing details of Architecture from copies.

(Art Directory, p. 24, § 3*b*, and p. 36, Stage 23*a*.)

b. A payment not exceeding 20*s.* for any one student, on account of every artisan student who shall submit satisfactory works, executed in the school or class during the then current school year, in drawing or designing for Architecture.

(*See* Art Directory, p. 25, § 3*c*, and p. 36, Stage 23*b*.)

c. Architectural Drawings of the class referred to in the preceding paragraph (§ *b*), executed by students in Science schools or classes are admissible to the advantages of the National Art Competition. (*See* Art Directory, p. 29, § 11.)

The works of students of classes in Subjects II. and III. are not excluded from the advantages of this rule, even if such students should be teachers in other Science subjects.

Free admissions to School of Mines and College of Science.

LXVII. Free admissions to the lectures at the Royal School of Mines, Jermyn Street, or the Royal College of Science, Dublin, are granted to any person who takes a gold medal in the May examination.

Persons who have taken a first or second class in the Advanced Stage in any subject of Science in the examinations of the Science and Art Department, and who show that they are bonâ fide Science teachers, may attend the day lectures gratuitously, provided that they be examined in at least one subject, paying a fee for such examination of *one pound* per course.

Candidates who have obtained a first or second class in the Advanced Stage may obtain tickets of admission to the Educational and Art Libraries at the South Kensington

Museum on application, by letter, addressed to the Secretary of the Science and Art Department.

LXVIII. Science teachers who have taught two years consecutively and passed not less than 30 students each year, are allowed 2nd class railway fare and 3*l.* towards their expenses while living in London —on condition that they remain there five days at least—for the purpose of visiting the South Kensington Museum and other Metropolitan institutions, in order that they may acquire for the benefit of their students a knowledge of the latest progress in those educational subjects which affect the schools. **Visits of teachers to London.**

Special arrangements with regard to these visits may be made from year to year.

For the year 1871 *arrangements will probably be made to enable a certain number of teachers to stay about six weeks in London to undergo a course of instruction in teaching certain special subjects. Should these arrangements be carried out such teachers will receive* 30*s. a week instead of the above payment.*

Before he proposes to take advantage of the grant the teacher must make application to the Secretary, Science and Art Department: he must also keep a diary (*apply for* Science Form No. 302) during his stay in London, giving the names of the institutions he has visited, with brief observations on them.

Note.—Science Form No. 170 (*see* next page) gives specific instructions as to the dates of returns, &c. *Special attention is called to this and to its concluding paragraph.* All the forms alluded to in this Directory, as well as the *Science Directory* and the *Art Directory* (price 6*d.* each), can be had on application to the Secretary, Science and Art Department, South Kensington, London, W.

Letters addressed thus need not be prepaid in the post.

APPENDIX A.

FORMS and INSTRUCTIONS for GUIDANCE in establishing and maintaining SCIENCE SCHOOLS and CLASSES.

SCIENCE FORM, No. 170.

MEMORANDA FOR THE USE OF SECRETARIES AND MEMBERS OF SCIENCE COMMITTEES.

Dates.	
Constantly - - -	To visit the School and see that the Registers are kept from day to day, and that the regulations of the Department are duly carried out.
When required -	To summon a meeting of the Committee on the occasion of the visit of the Inspector.
1*st November* -	The Report, Science Form No. 120, informing the Department of the existence of a school must be carefully filled in and sent immediately on its opening, or if it be an old school, on its re-assembling after the vacation. This must be accompanied or closely followed by Form No. 88, forming the Committee, or No. 168, continuing a Committee. *Note.—If the Committee of any School or Class has not been at least provisionally approved by the Department before the* 1*st of February in any year, no payments will be made on the results of the examination of that School or Class in the ensuing May.*
Before 28*th Feb.* -	To send Form No. 329, stating in what subjects examination will be required.
Before 31*st March*	To send Form No. 119, giving the precise number of candidates in each subject at the examination in May. *Note.—No examination will be held where these forms have not been sent in by the dates named.*
Before 24*th April* -	To see that Form No. 91 is hung up in the School-room.
On the 27*th April*	If a parcel containing (1) the papers for the candidates to work upon, (2) copies of Form No. 91, one for each day's examination, and (3) envelopes in which to return the worked papers, should not have been received, or if there should be any mistake in the numbers sent for each subject as applied for, or in the covering letter, to communicate *at once* to the Department.
During the May examinations.	The examination papers for each evening will leave London by the night mail two evenings before, *i.e.*, Thursday evening papers will leave on Tuesday evening, Friday's on Wednesday evening, Monday's on Friday evening, etc. Should they not arrive accordingly, a telegram to be sent *at once* to the Department.

On the evening of examination. The candidates, being all seated at 6.50, to read out the rules on Form No. 91, then give out the papers to be worked on. Then at 6.55 to break the seal of the examination papers and distribute to the candidates. To adhere rigidly to the rules on Form No. 91. To sign Form No. 91. To seal up the papers in one of the envelopes provided and at once post them.

If no candidates are examined the envelope of examination papers to be returned unopened, or if two sets of papers have been sent, one set to be returned unopened. To return Form No. 400 before 25th May.

After the May examinations. On receiving printed lists of the results, to give one copy to each candidate whose name appears in it as being successful; to inform the others that they have failed.

To return, as soon as possible, Form No. 161, filled up in strict accordance with the rules on Form No. 110. (Prize List). To call a meeting of the Committee to examine and certify the Teacher's claims for payment, Form No. 51, and the School and Class Registers, which must be sent up at the same time. To return Form No. 108.

To keep a record, and inform the Department, of the number of individuals examined.

NOTE.—*Whenever it becomes necessary to write to a school for a form, or for a return which ought to have been made, and through neglect has not been sent in, a stoppage of five shillings will be made from the next payments on results; and for every day's delay through neglect in sending in the returns noted on this form a stoppage of half-a-crown.*

SCIENCE AND ART FORM, No. 88.

LOCAL COMMITTEES FOR SCHOOLS AND CLASSES RECEIVING AID THROUGH THE SCIENCE AND ART DEPARTMENT.

1. A Local Committee of not less than five well-known responsible persons must be formed in connexion with every school or class, in order to comply with the necessary requirements of the Science and Art Department, and to carry out various arrangements on its behalf necessary for testing the efficiency of the instruction, on the proof of which alone the aid of the Department will be given.

2. The gentlemen who intend to act on this Committee must sign the form on the next page, stating their willingness to carry out the necessary arrangements for examinations, and to observe all the regulations of the Department; each member after signing must also give his address and occupation. Care must be taken that the members who sign the form are properly acquainted with the duties they propose to discharge; a summary of these duties is given below (see § 5), and they are laid down at greater length in the Science and Art Directories, which can be obtained on application to the Secretary of the Department.

3. When a school or class is first formed, the form on the next page must be signed at a general meeting of the Committee. If the same Committee continue to act, it will only be necessary to fill up Form No. 168, which expresses the willingness of the members to undertake their duties for another year: but no one can be a member of a Committee, nor

assist in the conduct of an examination, who has not signed the form on the next page.

The relation of the teacher to the Committee of a school or class will vary much, according to the varying circumstances of different localities. With this and other local arrangements the Science and Art Department does not interfere, but leaves them to the locality to settle.

5. The Science and Art Department requires that the Local Committee hall—

a. Be responsible for the safe custody of all apparatus towards the purchase of which the Department has granted aid.

b. Provide a room or rooms of sufficient size to carry out the annual examination according to the detailed regulations under that head. This examination is of *all* persons who wish to present themselves, and not only of those attending the school or class; but those persons who do not belong to the school or class must send in their names at the appointed time, and may be required to pay a registration fee of 2*s*. 6*d*. for the whole examination.

c. See that the school registers, showing the occupations of the various students, their attendance, number of lessons, payments of fees, &c., on the approved forms (Science Forms Nos. 139 and 139*a*, and Art Forms Nos. 531, 532, 533, and 534), be kept properly filled up, and sent to the Science and Art Department when required.

d. Send, when required, to the Secretary of the Science and Art Department the list of students to be examined, specifying the subjects in which they are to be examined. Be responsible for conducting and superintending the examinations in accordance with the rules of the Department; giving out the examination papers which will be sent for that purpose: seeing them fairly worked and certifying to the same, not less than three of the Committee being always present: and sending the worked papers, under seal, by the day's post to the Secretary of the Science and Art Department.

e. When required, transmit to South Kensington works for examination executed in the school during the previous year, and make an annual report of the proceedings of the school or class.

f. Certify that those students on whose examination claims to payments on results are based, are artisans or operatives, or can claim as such; and that the payments claimed are due according to the regulations.

g. Certify that those students, on account of whose instruction in Science payments are claimed, have received 25 lessons at least from the teacher in the year, or since the last examination, on their passing at which payment was claimed on their account.

6. The school or class must be at all times open to the visit and inspection of the officers of the Science and Art Department as a condition for the grant of aid from it; if at any time it is found that the apparatus, examples, &c., towards the purchase of which a grant has been made are not properly taken care of, or that a proper room with firing, lighting, &c., is not provided for the class, the aid of the Department may be withdrawn.

7. The school or class will be inspected periodically by an officer of the Science and Art Department, who will report whether the regulations be strictly carried out. At his visits, of which due notice will be given, a meeting of the Committee must be held to receive him, when as many of the members as possible are expected to attend.

FORM of APPLICATION to act as a COMMITTEE for a SCHOOL or CLASS receiving AID through the SCIENCE and ART DEPARTMENT.

This Form is to be filled in, signed at a general meeting of the Committee, and returned to the Department immediately on the formation of a school or class.

If the Committee of any school or class has not been at least provisionally approved by the Department before the 1st February in any year, no payments will be made on the results of the examination in the ensuing May of that school or class.

When a Committee continues to act for another year for a school or class, Form No. 168 *should be transmitted, and this form be signed by new members only.*

We, the undersigned,

[*h.* The Committee must consist of a Chairman, Secretary, and at least three other Members, and must be composed entirely of well-known responsible persons of independent position, who have no such personal interest in the school or class as can lay them open to the slightest suspicion of partiality. Relations and pupils of the teacher, persons wishing to be examined, or who are under instruction in any school or class receiving aid from the Science and Art Department, and teachers of any description having pupils who are candidates for the examinations of the Department, are not eligible as members of the Committee.

NOTE.—A gentleman whose son or daughter attends any examination of the Science and Art Department is thereby disqualified from superintending any of the examinations that year, though he may act on the Committee in other respects.

i. It is very desirable that as many persons as possible in recognised positions of public responsibility in the district, such as Magistrates, Municipal Authorities (Mayor, Aldermen, or Town Councillors), Heads of Educational Establishments (Trustees of Grammar Schools, Managers of National Schools), Clergymen, &c., should be on the Committee. It is *absolutely necessary* that at least two such responsible persons should agree to act.

k. The Chairman must be a Magistrate, Mayor, Boroughreeve, Provost, Alderman, or other public officer of recognised position, Trustee of Grammar School, Clergyman of the Established Church in parochial employment, or minister of religion in charge of a licensed place of public worship. He will have to certify that the constitution of the Committee is in accordance with the above requirements.

l. The Secretary of the Committee of the School or Class, as being the medium of communication, will carry on all correspondence with the Science and Art Department, and is held responsible for making out and sending all returns required, for the receipt and distribution of the examination papers, the transmission of the worked papers, &c., at the proper times according to the regulations.]

propose to act as the Local Committee for the

______________________________ [Science School, Science Class, School of Art, or Art Night Class.]

held at the ______________________________ [Name of Institution or Building.]

______________________________ [Name of Street or Place.]

______________________________ [Name of City, Town, or Village.]

and taught by ______________________________

____

______________________________ [Give the names of all the teachers.]

We undertake for the year ending 31st August 18 at least, and further till another Committee satisfactory to the Science and Art Department has been appointed,

1. To be responsible for the safe custody of all the Apparatus, Diagrams, Examples, Casts, &c., towards the purchase of which the Department has in any way contributed.
2. That three or more of our number will be ready at the appointed time to be present at, and superintend, the examinations of the School or Class according to the instructions of the Science and Art Department, and give the teachers the necessary vouchers.
3. That a room or rooms shall be provided for the due carrying out of such examination, according to the rules of the Department, providing sufficient space for the examination, not only of all persons taught in the School or Class, but of all others who may wish to attend the examination.
4. When required to transmit to South Kensington works for examination, and to make an annual report of the School or Class; and to comply with the regulations of the Science and Art Department.

   (A fee of not more than 2s. 6d. may be charged on each applicant for examination who is not a student in the class, to reimburse the Committee for any extra expenses they may be put to in providing a room.)
5. That the School or Class shall be open at any time to the visit and inspection of the Officers of the Science and Art Department.

SIGNATURE.	ADDRESS.	Occupation, specially stating how fulfilling the conditions of rules "h" and "i" above.
NOTE.—*On the formation of a Committee this form should be signed at a general meeting.* ______________ *Chairman.* ______________ *Secretary.*		

I certify that this Committee complies with the requirements of the rules *h*, *i*, and *k*.

____

Chairman.

It occasionally happens that there are gentlemen interested in the school whom it would be advantageous to have on the Committee, but who are disqualified according to rules *h*, *i*, *k*, from acting on the Committee in any of the business connected with the examinations. These gentlemen must sign the form below.

We agree to the preceding undertaking with the exception of clause 2.

SIGNATURE.	ADDRESS.	OCCUPATION.

I recommend that the gentlemen named above may be allowed to act on the general committee of management, it being understood that they will have nothing to do with the examination.

______________________ *Chairman.*

The Secretary,
Science and Art Department,
South Kensington, London, W.

SCIENCE AND ART FORM, No. 168.

FORM OF APPLICATION TO RENEW A COMMITTEE.

To be sent in before the 30th November.

SIR,

WE have the honour to inform you that a meeting of the Committee of

the ______________________________ [Science School, Science Class, School of Art, or Art Night Class.]

established at the ______________________________ [Name of Institution or Building.]

at ______________________________ [Name of Town or Village.]

was held at the ______________________________ [Place of Meeting.]

on the ____________________, at which the following members were present:—

and we were authorised by them and the following members,

who could not attend, to inform you that they are prepared to continue to act

as the Committee of the ______________________________ [School or Class.]

for the year ending 31st August 18 .

We have also to inform you that additional members who have joined the Committee have signed the enclosed Form No. 88. [This paragraph to be erased if it does not apply.]

The School will be taught by the following teachers during the session:—

____

____

____

We have the honour to be, SIR,
Your obedient Servants,

______________________________ *Chairman.*

______________________________ *Secretary.*

To the Secretary,
Science and Art Department,
South Kensington, London, W.

SCIENCE FORM, No. 120.

SCIENCE CLASSES UNDER TEACHERS QUALIFIED TO EARN PAYMENTS.

ANNUAL REPORT OF SCIENCE SCHOOL OR CLASS,

To be made on its establishment, and annually immediately on recommencing after the summer vacation.

In all cases this form must be sent in before the 1st November.

Name of Town ____________________

Place, as Mechanics' Institution, &c., in which the Classes are held } ____________________

Name of Street, No., &c. ____________________

Teachers' names.	Their private addresses.

Total No. of individual Students ____________

(If a student attends two or more classes he must only be counted as one student.)

CLASSES IN (state subject in terms of the Science Directory).	Fees.	No. of Students.	Days on which they meet.	Hours of Meeting.	Period of the Year during which the Classes continue.

____________________ *Secretary.*

____________________ *Address of Secretary.*

SCIENCE FORM, No. 51.

Application for Payment from ________________ [Name of teacher.]

Science Teacher in ________________ [Name of school or institution.]

at ________________ [Name of town or village.]

On behalf of the Committee of Management of this School, We do hereby certify that :—

(1.) Mr.____________ has duly performed the various duties devolving upon him as a Science Teacher in the School, during the ______ ending ______ day of __________ 18 .

(2.) He has given the following students at least 25 lessons during the year, or since the last examination at which payment was claimed on their account, in each subject for which payment is claimed.

(3.) The under-mentioned students belong to the industrial classes, as coming within one of the following categories :—

a. Artisans or operatives in the receipt of weekly wages.
b. Coastguards, policemen, and others who, though in the receipt of weekly wages, do not support themselves by manual labour.
c. Teachers of elementary schools in connexion with the Education Department, Whitehall, or the National Board of Education, Ireland.
d. Persons in the receipt of salaries not large enough to render them liable to the income tax, as some descriptions of clerks, shopmen, &c.
e. Small shopkeepers employing no one but members of their own family, and not assessed to the income tax.
f. Tradesmen and manufacturers on their own account, supporting themselves by their own manual labour, not employing apprentices, journeymen, &c., and not assessed to the income tax.
g. The children (not gaining their own livelihood) of all such persons above mentioned.

Examined and certified at a meeting of the Committee held for that purpose at ________ [Place of meeting.] on the ____ day of ____ 18 .

________________ *Chairman* or *Secretary.*

____
________________ } *Two members of Committee.*

I hereby certify that the following particulars are correct.

________________ *Teacher.*

________________ [State how qualified to earn payment.]

Names of Passed Students.

N.B.—The names of the students must be arranged alphabetically. After each student's name must be placed, each in a separate line, his several successes (if he has more than one); and in the last column the amount claimed on each success, after making the proper deductions.

Surname.	Christian Name in full.	Age last Birthday.	Trade, or Father's Trade. When father's trade is given put (*f.*) after it.	State under which of the Categories, *a*, *b*, *c*, *d*, *e*, Claim is made.	Position at the late Examination. Subject. *In Roman Numerals.*	Stage.	Class. *In Arabic Numerals.*	Highest Position in same Subject in any previous Examination.	Payment claimed.

[SPECIMEN.]

SCIENCE FORM, No. 51.

Application for Payment from *William Brown,* [Name of teacher.]
Science Teacher in *the Mechanics' Institute,* [Name of school or institution.]
at *Worksop* [Name of town or village.]

On behalf of the Committee of Management of this School, We do hereby certify that:—

(1.) Mr. *William Brown* has duly performed the various duties devolving upon him as a Science Teacher in the School, during the *year* ending *30th* day of *June* 18*70;*

(2.) he has given the following students at least 25 lessons during the year, or since the last examination at which payment was claimed on their account, in each subject for which payment is claimed;

(3.) the under-mentioned students belong to the industrial classes, as coming within one of the following categories:—

a. Artisans or operatives in the receipt of weekly wages.
b. Coastguards, policemen, and others, who though in the receipt of weekly wages, do not support themselves by manual labour.
c. Teachers of elementary schools in connexion with the Education Department, Whitehall, or the National Board of Education, Ireland.
d. Persons in the receipt of salaries not large enough to render them liable to the income tax, as some descriptions of clerks, shopmen, &c.
e. Small shopkeepers employing no one but members of their own family, and not assessed to the income tax.
f. Tradesmen and manufacturers on their own account, supporting themselves by their own manual labour, not employing apprentices, journeymen, &c., and not assessed to the income tax.
g. The children (not gaining their own livelihood) of all such persons above mentioned.

Examined and certified at a meeting of the Committee held for that purpose at *the Mechanics Institute, Worksop* [Place of meeting.] on the *25th* day of *July* 18*70.*

John Richards, Chairman ~~or Secretary.~~

Alfred H. Dickson
Walter Harrison } Two members of Committee.

I hereby certify that the following particulars are correct.

William Brown, Teacher.

2nd Class Certificate in I., II., III.; 1st Class in X. and XI., 1867; 2nd Class in VIII. and IX., 1868; 2nd Class Honours in IV., 1869. [State how qualified to earn payment.]

NAMES OF PASSED STUDENTS.

N.B.—The names of the students must be arranged alphabetically. After each student's name must be placed, each in a separate line, his several successes (if he has more than one); and in the last column the amount claimed on each success, after making the proper deductions.

Surname.	Christian Name in full.	Age last Birthday.	Trade or Father's Trade. When father's trade is given put (*f.*) after it.	State under which of the Categories, *a*, *b*, *c*, *d*, *e*, Claim is made.	Position at the late Examination. Subject. *In Roman Numerals.*	Stage.	Class. *In Arabic Numerals.*	Highest Position in same Subject in any previous Examination.	Payment claimed.
									£
Adams -	*John James.*	*14*	*Tailor (f.)*	*e.*	*X.*	*A.*	*1*	*E.*	*2*
”	”	”	”	”	*XI.*	*E.*	*2*	—	*1*
			Carried over						£3

Names of Passed Students.

N.B.—The names of the students must be arranged alphabetically. After each student's name must be placed, each in a separate line, his several successes (if he has more than one); and in the last column the amount claimed on each success, after making the proper deductions.

Surname.	Christian Name in full.	Age last Birthday.	Trade, or Father's Trade. When father's trade is given put (*f.*) after it.	State under which of the Categories *a, b, c, d, e,* Claim is made.	Position at the late Examination. Subject. *In Roman Numerals.*	Stage. *A. or E.*	Class. *In Arabic Numerals.*	Highest Position in same Subject in any previous Examination.	Payment claimed. £ s.
			Brought forward	- -	- -	- -	- -	- -	3 0
Carter -	*William Henry.*	*22*	*Clerk in Gas Works.*	*c.*	*X.*	*E.*	*1*	*E. 3*	*1 10*
Jones -	*Richard*	*23*	*Bricklayer*	*a.*	*I.*	*E.*	*1*	*E. 2*	*1 0*
"	"	"	"	"	*III.*	*A.*	*2*	*E. 2*	*1 0*
Robinson	*Peter Charles.*	*20*	*Fitter* -	*a.*	*I.*	*A.*	*1*	*A. 2*	*1 0*
"	"	"	" -	"	*II.*	*A.*	*2*	*E. 1*	*1 0*
"	"	"	" -	"	*IV.*	*E.*	*2*	—	*1 0*
Smith -	*Robert*	*13*	*Postman (f).*	*b.*	*VIII.*	*A.*	*1*	*E. 2*	*2 0*
"	"	"	"	"	*IX.*	*E.*	*2*	*E. 3*	*0 10*
"	*Arthur H.*	*15*	*Publican (f).*	*d.*	*IV. and V.*	*3*	*1*	*A. 2 in IV.*	*2 0*
Thomson	*Charles*	*16*	*Office-boy*	*b.*	*IV. and V.*	*1*	*1*	*E. 2 in IV.*	*Nil.*
"	*George* -	*19*	*Joiner's App.*	*a.*	*IV. and V.*	*3*	*1*	*A. 1 in IV.*	*1 0*
"	"	"	"	"	*IV. and V.*	*4*	*2*	*E. 3 in V.*	*1 0*
"	"	"	"	"	*IV. and V.*	*6*	*2*	"	*1 0*
Watson	*William*	*18*	*Pupil-teacher.*	*c.*	*IV. and V.*	*3*	*2*	*A. 2 in IV.*	*1 0*
"	"	"	"	"	*IV. and V.*	*5*	*1*	*E. 2 in V.*	*1 0*
"	"	"	"	"	*IV. and V.*	*7*	*2*	"	*1 0*
									20 0

SCIENCE FORM, No. 91.

RULES FOR THE CONDUCT OF SCIENCE EXAMINATIONS.

The following rules must be hung up in the examination rooms or the class rooms for the information of the candidates one week before the examination. They should all be carefully read by the members of the Committee, and those applying to the candidates must be read aloud before the Committee and the candidates **on each night** *immediately before the examination begins.*

DIRECTIONS TO THE COMMITTEE.

N.B.—The rules are perfectly definite, and in order that the duties of the committee may be as little onerous as possible, it is not left to any one's discretion to modify the rules in the smallest detail.

1. If one room is used, three of the Committee must be present during the whole of the examination, if more than one room then two of the Committee in each room, who must carefully watch the whole examination and see that candidates use no unfair means either by assisting one another or using books or notes. The members of the Committee can, if they wish it, relieve one another, as long as the correct number are always present. *No persons except those under examination, members of the Committee, and officers of the Science and Art Department are permitted to be present in the room during the examination.*

NOTE.—When there are not more than three candidates it will not be necessary for more than two members of the Committee to be present at the examination.

2. Places must be allotted to the candidates so that they may be seated at least five feet apart, from centre to centre. Ink and pens must be provided. All diagrams, &c., having reference to the subjects of the examination, must be removed from the walls of the examination room. All these arrangements for the accommodation of candidates should be completed by 6.30 p.m.

3. It may be of service to the Committee that the teacher of the class should attend before the examination begins to assist in getting the candidates into their places; his doing so, however, is at the discretion of the Committee. He may see the candidates fill up the forms on the outside of their papers and arrange them in classes for the elementary and the advanced papers, and for honours, which he will explain to the Committee so that there may be no confusion. But *he must leave the room before the examination papers are opened:* information of his having remained in, or returned to the room after this will lead to the examination being cancelled.

NOTE.—Should the teacher of the class wish to be examined, he must apply specially to the Committee, so that they may arrange to have a table for him close to their own seats, and not with the other candidates.

4. The blank papers supplied by the Department for the candidates to write their answers on should be first distributed, and the Committee should see that the candidates commence by filling in their names, &c., where directed. The arrangement of the candidates and distribution of the papers should be completed before 6.50 p.m.

NOTE.—Should no candidate present himself for examination, the packet of examination papers must be returned to the Department by the next post *unopened.*

5. At 10 p.m. or, as much sooner as all the candidates have completed their papers, the worked papers must be sealed up in the envelope supplied by the Department for that purpose. Before they are thus sealed up neither the teacher nor any other person, not being a member of the Committee, must be allowed to enter the room.

As soon as they are sealed the packet of papers should (if possible) be immediately posted. If it be impossible to post it the same night it should be placed in the charge of a *member of the committee* and posted the first thing the next morning.

6. On these examinations depend large grants of public money. On their being fairly, honestly, and impartially carried out depends the continuance of the system. The Committees are intrusted with this duty, *but they have no authority to modify the rules in any particular.* They will see, then, how necessary it is to be extremely careful in conducting the examinations, and to insist on the rules being complied with *to the letter.* They are therefore required to fill in and sign the certificate on the third page of this form, and to forward the same with each set of worked papers.

The worked papers of the candidates are, as will be seen from Rule 12, below, to be initialed by members of the Committee. This is to prevent personation. And the Committee will see how essential it is that this duty be not treated as a mere matter of form.

REGULATIONS APPLYING TO THE CANDIDATES.

To be read to the Candidates on each evening before the Examination Questions are opened.

7. The candidates must be in their places at 6.50 p.m. After this time no candidate should be admitted except under very exceptional circumstances, and by express permission of the Committee, and then *only* if no person has left the room who has seen the examination paper. No candidate may on any account be admitted after 7.30 p.m.

8. The examination papers must be opened in the examination room in the presence of the Committee, at 6.55 p.m. No examination paper may on any pretence be taken from the room before 8 p.m.; *nor after that hour until every candidate has completed and given up his worked paper.*

9. Candidates should not bring anything with them into the examination room,* except pens and pencils. No *blotting paper*, scribbling paper, slates, or anything of the sort that might be passed from one candidate to another, is on any account to be allowed. Rough work and calculations must be done on the supplied form. The back of each leaf of the form, *i.e.*, pages 2, 4, 6, and 8, may be reserved for this purpose, the pen being drawn through to show that they are not for the examiner. *But nothing must be torn off the form.* All books, note-books, &c. must be collected by the Committee.

10. Candidates must not on any pretence whatever speak to one another after the papers have been given out. If a candidate should require to ask a question, he will hold up his hand, when a member of the Committee will attend to him, but no question on the meaning of any portion of the examination paper must be asked or answered.

11. When the examination papers have been given out no candidate may be allowed to return after having once left the room.† On a candidate leaving the room before the examination is over his worked paper and examination questions must be taken up, and he must deliver his paper of questions to the Committee, though he may have them again after his examination is over. At 10 p.m., precisely, all the

* Except such as by the Time Table (Science Form, No. 90) are required.

† It will, therefore, be desirable to make some arrangements for the candidates to retire within the room.

candidates' papers must be collected. It will therefore be advisable to warn them ten minutes before the time. No candidate should on any pretext be allowed to leave the room before 8 o'clock. After that hour, when a candidate has completed his work before 10 p.m., he should be directed by the Committee to leave the room after his worked paper has been taken by a member of the Committee.

12. The papers should be initialed, by the Committee as directed, as they are received from each candidate, as a guarantee that each has been worked by him whose name, &c. it bears. Every paper on which a candidate has written his name, or which bears any marks of his work, must be returned in the sealed packet to the Department.

13. *Should a candidate break any of the foregoing rules, or use unfair means of any description, he must be at once expelled the examination room, and his paper cancelled, the Committee stating on it the cause of his expulsion.*

Certificate by the Committee.

To be filled in and signed by the Committee and forwarded with each set of worked papers.

We, the undersigned members of the Committee of the Science School or Class held at ____________________

____________________ [name of institution and town.] in ______ [state number of] rooms hereby certify that we were present during the examination

____________________ [state Subject.]

held in the ____________________ [name of building.] on the evening of the ____________________ where the accompanying papers were worked in our presence, and that the foregoing rules have been strictly complied with.

Dated this __________ day of ______________ 18 .

Signatures.	Time Present.	
	Hour of Arrival.	Hour of Departure.

Science Form, No. 402.

LIST OF APPARATUS FOR LABORATORY PURPOSES.

Where a School Laboratory has been established, aid is granted towards the expenses incurred by students in a course of Laboratory Practice according to the regulations laid down in § LXIII., at p. 26 of the Science Directory. The following is a list of apparatus with which each student should be furnished :—

	s.	d.
Conical brass blowpipe with bone mouthpiece	2	0
6 inches platinum wire	0	6
Platinum foil, 2 inches long, and 1 inch wide	1	0
Test tube stand, 24 holes	2	0
18 test tubes, 6 in. by ¾ in.	1	9
12 test tubes, 5 in. by ½ in.	0	10
2 boiling tubes, 8 in. by 1¼ in.	0	5
2 Test tube brushes	0	5
Set of 3 beakers	1	0
German flasks, 1 of each, 2 oz., 4 oz., 8 oz., 16 oz., and 30 oz.	1	9
Berlin porcelain crucible 1½ inch diameter	0	4
Berlin porcelain evaporating basins, one of each, 2¾ in. and 3½ in. diameter	0	11
Funnels, one of each, 1½ in., 2 in., and 3 in.	0	6½
English filter paper, cut, two packets of 100 filters each 2¾ in. and 4½ in diameter	0	9½
Iron retort stand with two rings, clamp, and square iron block	7	0
Iron wire gauze, 5 inches square, 2 pieces	0	4
Tin plate sand bath 5 inches diameter	0	4
6 watch glasses, 2 inches diameter	0	6
½ lb. soft glass tubes $\frac{3}{16}$ to ¼ in. diameter	0	8
½ lb. combustion tube ⅜ in. bore	0	8
¼ lb. glass rod $\frac{3}{16}$ in. diameter	0	4
2 feet black caoutchouc tube ⅜ in. bore	1	4
2 feet black caoutchouc tube ⅛ in. bore	0	8
Thistle funnel, 18 inches long	0	4
3 dozen assorted corks	1	4
Woulf's bottle, 2 necks, pint size	1	3
Stoppered German glass retort, 2 oz.	0	7
Set of three cork-borers, $\frac{3}{16}$, ¼, and ⅜ in. with iron rod	1	0
Triangular file and handle	0	8
5 inch round file and handle	0	9
Bunsen's gas burner, with blowpipe jet, star support, chimney, and rose burner	3	6
Iron crucible tongs	1	0
4 inch porcelain mortar	1	0
Box of test papers, blue and red litmus	0	6

	s.	d.
Solution of Cobaltous nitrate ½ oz. stoppered bottle - -	0	7
„ Argentic „ ½ oz. „ - -	0	6
„ Platinic chloride ½ oz. - - - -	1	9
1 pint methylated alcohol in bottle - - - -	1	6
Glass spirit lamp, 4 oz. capacity - - - -	0	9
Deal box to contain the set of apparatus - - -	2	0
£2	5	1

The set complete can be obtained in a box for 2*l.* from Messrs. J. J. Griffin & Son, Garrick Street, London, W.C.; or Messrs. Jackson and Townson, 89, Bishopsgate Street Within, London, E.C.; but schools are not required to purchase the apparatus at these manufacturers.

NOTE.—The above set of apparatus may be used by two pupils making the same experiments conjointly, but this is not recommended.

FORM No. 694.

SUMMARY of the LAW relating (I.) to the ESTABLISHMENT and MAINTENANCE of PUBLIC LIBRARIES, MUSEUMS, and SCHOOLS of SCIENCE and ART, and (II.) to the ACQUISITION of SITES for such INSTITUTIONS.

N.B.—This summary has been prepared for the **general information only** *of persons desiring to establish Museums and Science and Art Schools, but it must be clearly understood that the Department does not hold itself responsible for its legal accuracy, and the promoters of such institutions are recommended not to take any definite proceedings under the Acts without availing themselves of professional advice.*

I.

1. Any town, parish, district, or union of parishes, is empowered by Act of Parliament (the Act for England is the 18 and 19 Vict. c. 70, Public Libraries Act, 1855; amended by the 29 and 30 Vict. c. 114. *As regards Scotland and Ireland, see* §§ 10 and 11 *below*), to levy a rate not exceeding one penny in the pound for the establishment and maintenance of buildings, with the requisite appliances, suitable for Public Libraries and Museums, or for Schools of Science or Art, or for any or all of these purposes, provided that a majority of more than one-half of the ratepayers present at a public meeting, duly convened, vote in favour of adopting the provisions of the Act.

2. The preliminary steps to be taken with a view to the adoption of the Act are these :—

(*a.*) In *Municipal Boroughs* the Act requires that the mayor shall convene a public meeting on the request of the town council, or on the request in writing of any ten resident ratepayers;

(*b.*) In *Districts* within the limits of any Improvement Act, the district board is to convene a meeting upon the requisition in writing of at least ten resident ratepayers; and

(*c.*) In *Parishes*, the overseers of the poor, on the written requisition of ten resident ratepayers, are to convene a meeting to determine whether the Act shall be adopted.

3. In each case it is necessary that ten clear days' notice of the time, place, and object of the meeting be given by affixing the same on or near the door of every church and chapel, and at least seven days' notice by advertisement in a newspaper published or circulating in the borough, district, or parish, as the case may be.

4. Any expenses incurred in connexion with the meeting, whether the Act be adopted or not, are chargeable upon the borough fund or rates, and may be defrayed, if necessary, by a separate rate specially levied for the purpose, such rate not to exceed one penny in the pound.

5. If any meeting duly convened to determine as to the adoption of the Act decides against it, no meeting for a similar purpose can be held until the expiration of at least a year from the time of holding the previous meeting.

6. If the Act be adopted the organisation for carrying its provisions into operation is as follows :—

(*a.*) In *Boroughs*. "The management, regulation, and control of "libraries and museums, schools for Science and Art, shall be "vested in and exercised by the council," or by such committee

as the council may appoint, and the members of the committee are not required to be members of the council.

(*b*.) In *Districts*. The board or trustees acting in the execution of the Improvement Act, or a committee appointed by them.

(*c*.) In *Parishes*. Not less than three nor more than nine commissioners to be appointed by the vestry, are constituted a body corporate for the purposes of the Act, under the name of "The "Commissioners for Public Libraries and Museums for the Parish "of —— in the County of ——."

7. The council, board, or commissioners are empowered to borrow money at interest, on the security of a mortgage or bond of the borough funds, or of the rate levied under the Act; and the provisions of the Companies Clauses, and Lands Clauses Consolidation Acts, 1845, are incorporated with the Public Libraries Act.

8. Where two or more neighbouring parishes combine for the purposes of the Act, each parish is to appoint not more than three commissioners, and the commissioners for the several parishes are to form one body corporate, and to act together in the execution of the Act. The expenses of carrying the Act into operation are to be borne by the parishes in such proportions as they may mutually approve.

9. It is important to observe that where a public museum or library has been already established under any Act relating to public libraries or museums, a similar institution, such as a School of Science or Art, may be established in connexion therewith without any further proceedings being taken under the Act.

10. The following are the general Acts of Parliament relating to the establishment and maintenance of public libraries, museums and Schools of Science or Art. Those printed in italics have been superseded by the others:—

Stats. 8 *and* 9 *Vict. c.* 43; 13 *and* 14 *Vict. c.* 65; 16 *and* 17 *Vict. c.* 101; 17 *and* 18 *Vict. c.* 64; 17 *and* 18 *Vict. c.* 103; 18 and 19 Vict. c. 40 (Public Libraries Act, Ireland, 1855); 18 and 19 Vict. c. 70 (Public Libraries Act, 1855); 29 and 30 Vict. c. 114 (Public Libraries Amendment Act, England and Scotland, 1865), repealed so far as it relates to Scotland by the 30 and 31 Vict. c. 37 (Public Libraries Act, Scotland, 1867).

11. The provisions relating to the establishment and maintenance of libraries and museums, &c. in Scotland and Ireland are substantially the same as the provisions of the Act for England, but there are some differences in matters of detail, for which it will be advisable to refer to the Acts themselves, namely, for Scotland, Stat. 30 and 31 Vict. c. 37, and for Ireland, Stat. 18 and 19 Vict. c. 40.

II.

12. By 17 and 18 Vict. c. 112 (intituled "The Literary and Scientific "Institutions Act")—after reciting the expediency of affording greater facilities for obtaining and settling sites and buildings in trust for institutions established for the promotion of literature, science or art, or for the diffusion of useful knowledge; it is provided that such persons and corporations, as are described in the 4 and 5 Vict. c. 38,* may

* These are, (1) any person being seised legally or equitably in fee simple, fee tail, or for life, in any manors or lands of freehold, copyhold, or customary tenure, and having the beneficial interest therein, in possession for the time being; and (2) any corporation, ecclesiastical or lay, sole or aggregate, in whom land may be, in any manner, vested,—subject to the proviso that no ecclesiastical corporation sole below the dignity of a bishop may make such grant without the consent in writing of the bishop of the diocese.

grant, convey, or enfranchise, either by gift, sale, or exchange, in fee simple, or for a term of years, any quantity, not exceeding one acre of their land, for each separate institution, as a site for such institution.

13. These powers are subject to provisos that they shall not be exercised by tenants for life unless the person or persons next in remainder join in the grant; that in case of gratuitous conveyance of waste or commonable land by any lord of a manor, the rights of all commoners and others having interest shall be barred; and that upon any land so granted by way of gift ceasing to be used for the purposes of the institution, it shall revert to the estate out of which it was granted, except only that when the institution is removed to another site, the land may be exchanged or sold for the benefit of the institution. The same Act, of 17 and 18 Vict. c. 112, contains numerous provisions relating to the persons by and to whom, and the manner in which, conveyances may be made; the form of such conveyances; the subsequent sale or exchange of the land; the liability of trustees to whom land is conveyed in trust; the ownership of any personal property belonging to the institution; the power to make byelaws; and the manner in which the institution may afterwards extend or abridge the purposes for which it was established, or may effect its own dissolution or the adjustment of its affairs.

14. The Act applies to every institution, for the time being, established for the promotion of science, literature, the fine arts, for adult instruction, and for the diffusion of useful knowledge. It also applies to the foundation and maintenance of libraries or reading rooms for general use among the members or open to the public, of public museums and galleries of paintings and other works of art, collections of natural history, mechanical and philosophical inventions, instruments, or designs.

15. The conveyance of sites to trustees, or others associated together for educational purposes, has been still further facilitated by recent legislation. It is no longer necessary to acknowledge any deed in order that it may be enrolled in the Court of Chancery (Act 31 and 32 Vict. c. 44. s. 3). If the grantor be a corporation, or if the conveyance be really and bonâ fide made for a full and valuable consideration, enrolment is no longer *compulsory*, although it is still permitted; but in all cases of voluntary grants by individuals, the deed must still, in conformity with the Mortmain Acts (9 George II. c. 36, 9 George IV. c. 85), be enrolled within six calendar months from the date of its execution (31 and 32 Vict. c. 44. s. 2).

SCIENCE FORM, No. 349.

REGULATIONS UNDER WHICH BUILDING GRANTS TO SCHOOLS OF SCIENCE ARE MADE.

1. A grant in aid of a new building suitable for a School of Science, or for the adaptation of an existing building, will be made provided that the school be built—

a. Under the Public Libraries Act (13 & 14 Vict. c. 65., 18 & 19 Vict. c. 70., 29 & 30 Vict. c. 114.), or,

b. In connexion with a School of Art aided by a Department building grant; and subject to the conditions herein-after set forth.

2. All applications for grants out of the parliamentary vote for any year must be sent in on or before the 15th day of November in the year preceding.

3. No grant will be made unless their Lordships are satisfied that,—

a. There is a population in the neighbourhood which requires a School of Science.

b. The school is likely to be maintained in efficiency.

4. No grant will exceed 2*s*. 6*d*. per square foot of internal area, and no grant will exceed 500*l*.

5. The site, plans, estimates, specifications, title and trust deed, must be satisfactory to the Lords of the Committee of Council on Education.

6. A plan of the site must be forwarded drawn to a scale of one-eighth of an inch to a foot, and showing the boundaries, approaches, and abuttals.

7. The site must be—

a. In a situation not unhealthy or noisy.

b. Within convenient distance of the homes of the students.

c. If possible freehold in tenure, without incumbrance of rights reserved over the surface, or reservation of minerals.*

8. The size and number of rooms will depend on local circumstances and the different sciences to be taught in the school. The plans and sections must be submitted with the application for the grant, and the proposed buildings must be in accordance with the regulations then in force as to size and distribution of rooms, ventilation, and substantial construction.

9. In cases where they may think it necessary, their Lordships will send an officer of the Department to inspect and report on the suitability of the building and site for the purposes of a School of Science.

10. The plans, specifications, and estimates when approved and sealed may be returned to the promoters for use, but must be lodged in the Science and Art Department.

11. A trust deed must be prepared providing—

a. That the building be used † as "a school for the instruction of "children and adults in the pure and natural sciences appli-"cable to industry and manufactures."

b. That it shall be open at all times to the inspection of the officers of the Science and Art Department.

c. That the students shall be instructed by teachers qualified to earn payments on the result of their teaching.

d. For the constitution of a body of responsible trustees and a committee of management.

12. This trust deed must not be executed until it has been approved in draft by the Lords of the Committee of Council on Education.

13. When the trust deed has been executed, and if necessary enrolled, a copy of it, including all signatures, attestations, and endorsements, must be made on plain unstamped paper, and lodged in the Science and Art Department.

14. The grant is made on presentation of a certificate (with balance sheet annexed) by the building committee of the school, setting forth that the building and conveyance are duly completed, and that the money in hand will, when added to the grant, meet all claims and finally close the account.

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* A leasehold site is not accepted by their Lordships when a freehold site can be obtained.

† If any power of sale, or of appropriating the premises to other uses than those of a School of Science be reserved, the deed must contain a condition securing the repayment of the grant to the Lords of Her Majesty's Treasury.

APPENDIX B.

SYLLABUS of the SUBJECTS in which EXAMINATIONS in SCIENCE are held by the DEPARTMENT OF SCIENCE AND ART.

SYLLABUS OF THE SCIENCE SUBJECTS.

THE following Syllabus has been prepared in order to afford candidates some guide to their reading; but it must be understood that the questions in the examination need not necessarily be on the specific points enumerated.

The examination is by paper, but oral examination may be resorted to. The examination in each subject is distinct. Mention is made of text-books solely to afford a candidate some assistance in selection, and a general idea of the scope of the examination, *and not at all to confine his reading to those works, or to assert that they are the best on the subjects they treat of.*

NOTE.—The "Art" examinations, in practical geometry of the 2nd grade, and in perspective, are held on the same evening as the "Science" examination in Subject I. The papers in practical plane geometry will be of the same character as they have been hitherto. The candidate should therefore be prepared—

(1.) To construct from sufficient data any triangles, parallelograms, polygons, circles, or ellipses required.
(2.) To place these figures in combination with one another.
(3.) To divides lines in given proportions.
(4.) To construct figures similar and proportional to given figures.
(5.) To reduce polygons to triangles of equal area and vice versâ.

The examination is based on Burchett's Practical Geometry.

This course may therefore be looked upon as a preliminary to Subject I.

In the Art examination in perspective of the 2nd grade, candidates will be required to put into perspective simple solids, or combinations of them, on a horizontal plane, or to ascertain the dimension of such solids from given perspective representations.

No problems will be proposed which cannot be solved by means of vanishing and measuring points on the horizontal line, either with or without the construction of a plan.

Burchett's Practical Perspective and Jewett's Perspective are recommended for study.

Malton's Brook Taylor's Perspective carries the subject further.

SUBJECT I.—PRACTICAL PLANE AND SOLID GEOMETRY.

Every one employed in any constructive art must acquire the power of representing on paper the forms and proportions of the work to be executed, whether it be of machinery, or of civil or naval architecture; and others, not immediately interested in construction require, in surveying, navigation, &c. a knowledge of practical as well as theoretical geometry of a more than elementary order.

Since it is essential to their utility that geometrical drawings should be accurate, the draughtsman must by practice and instruction be sufficiently skilful in the use of his instruments and materials to ensure neatness as well as precision of execution: without these qualifications it is assumed that no one will present himself for examination in this subject.

But although prepared to this extent, the subject may be new to many, especially to those not acquainted with the application of arithmetic and algebra to geometry; it may therefore be necessary to apprise candidates, not only of what kind of knowledge will be expected, but of the form in which the examination papers will be drawn up.

Each paper will contain questions in both plane and solid geometry, about 12 in number, of which the candidate may select any number not exceeding eight, but to obtain a class in either course, a large preportion of the questions answered must be from the solid geometry.

The candidate must also understand that he must strictly comply with the conditions of each question, and not imagine that by substituting

others, provided they are analogous, he may obtain credit for his answer; strict impartiality would be violated by any such latitude. He should also be most careful in attending to the instructions issued to him with the examination questions.

In neither stage must the student expect all the examination questions to be in the very words of the syllabus. He must rather look forward to having problems placed before him, the solution of which depends upon his intimate knowledge of the classes of problem outlined below.

First Stage or Elementary Course.

Plane Geometry.

1. Exercises in neatness and accuracy not requiring any advanced knowledge of geometry, *e.g.*, the construction of an irregular polygon when the length of its sides and magnitude of its angles are given, &c. :—
2. The construction of plain scales.
3. Problems where straight lines only are concerned.
   - *a.* To draw a straight line perpendicular to a given straight line, through a given point, the latter being either within or without the given line.
   - *b.* To divide a line so that the segments may have a given ratio.
   - *c.* To find a mean proportional or a third proportional to two straight lines.
4. To construct a regular polygon of *n* sides upon a given base.
5. To reduce a polygon of *n* sides to an equivalent triangle.
6. To draw circles to touch given lines or circles, or more generally, to work problems where the straight line and circle are involved in various combinations.

Solid Geometry.

A general knowledge of the principles of Projection, and of the meanings of those terms which are in constant use, such as Plan, Elevation, Section, Trace, &c.

Application of those principles, and illustration of the terms in the case of a simple solid resting on the horizontal plane.

Generally :—The elements of descriptive geometry carried so far as to enable the student to represent a solid by its plan and elevation :—

a. When the inclination of one of the planes of that solid is given, and also that of some line connected with the solid and lying in that plane.

b. When the inclinations of two lines connected with the solid are given.

Second Stage or Advanced Course.

Plane Geometry.

1. The division of finite lines, or those lines produced under any of the conditions stated in the previous course, or under those of a more comprehensive character, such as harmonically, &c.

2. To determine by construction *lines* which shall be equivalent to magnitudes given by algebraical expressions, such as—

$a.\ \sqrt{m},\quad \sqrt{\frac{m}{n}},\quad \sqrt{\frac{1}{m}}$; ($m$ and n being *numbers*.)

$b.\ \overline{a^2 \pm b^2},\quad \sqrt{ab},\quad \frac{\sqrt{ab}}{c},\quad \frac{\sqrt{m} \pm n}{k}$, &c., &c.

3. The construction of polygons from adequate conditions of sides, angles, area, or perimeter.
4. The division of polygons into m areas by parallel lines, or by lines drawn through a given point.
5. To draw circles to touch given lines and circles and to pass through two given points.
6. The construction of those plane curves which are required in practical arts (ellipse, parabola, cycloid, spirals, &c., &c.)
7. The construction of "scales" to drawings, to different units of measure, English and foreign, both plain and diagonal.

Solid Geometry.

a. A more searching examination in the principles and elementary problems of descriptive geometry.

b. Representation of a solid by its plan and elevation when,—
   1. A plane connected with the solid is given, and a line lying in that plane.
   2. Two lines connected with the solid are given.
   3. Two planes do. do.
   4. The height of three points of the solid are given.

c. Problems on the sphere, cone, and cylinder,—
   1. Representation of those solids in given positions and in contact.
   2. The determination of planes tangential to them.
   3. The determination of their sections by planes under given conditions.
   4. The intersection of their surfaces when variously combined, or "penetration."

d. The determination of the shadows of solid bodies bounded either by plane or curved surfaces, as cast by either parallel or converging rays of light.

e. Isometrical projection.

Examination for Honours.

Plane Geometry.

Candidates for honours will be required to make constructions relating to the contact of lines and circles with each other, and with other curves, requiring more knowledge of geometry and the power of making

deductions, than is expected of other candidates; but the questions on these and other subjects will be of a practical utility in geometrical drawing. They must possess some knowledge of analytical geometry, so as to be able to construct lines or circles given by algebraical expressions referring to co-ordinate geometry of two dimensions, such as $\frac{x}{a}+\frac{y}{b}=1$; $x \sin A + y \cos A - p = 0$; $(x-a)^2+(y-b)^2=r^2$, &c., &c.

They should also possess a sound knowledge of the properties of the conic sections, and of those other curves which admit of practical application, such as the epicycloid, evolute, &c.

Solid Geometry.

Problems will be given both in orthographic and radial (or perspective) projection. Amongst other subjects in the former of these must be studied that branch known as isometric projection, the solution of the cases of the spherical triangle by construction, the development of surfaces, and the intersection of curved surfaces. In the radial projection the student must show that he is acquainted with the geometrical principles of that method, and not merely be capable of "*putting into perspective*" a given solid.

The following books are recommended for study in Subject I.:—

For Theoretical Geometry.

Any of the numerous editions of Euclid's Elements, such as,—

Euclid's Elements of Geometry (School Edition), by R. Potts, 12mo., 4*s*. 6*d*. (London, Longman, 1868.)

Geometry, Plane, Solid, and Spherical (Library of Useful Knowledge). (Baldwin, 1830.)

For Analytical Geometry.

Treatise on Plane Co-ordinate Geometry as applied to the Straight Line and the Conic Sections, by I. Todhunter, 8vo., 7*s*. 6*d*. (London, Macmillan, 4th ed., 1867.)

A Treatise on Conic Sections, by G. Salmon, 8vo., 12*s*. (London, Longman, 4th ed., 1863.)

Treatise on the Analytical Geometry of Three Dimensions, by J. Hymers, 8vo., 10*s*. 6*d*. (Cambridge, Deighton, 3rd ed.)

A Treatise on Algebraical Geometry, by W. Waud (Library of Useful Knowledge). (Baldwin, 1835.)

For Practical Geometry.

Practical Geometry, by Thos. Tate (Gleig's series), 18mo., 1*s*. (London, Longman, 1868.)

Elements of Geometrical Drawing, by Thos. Bradley, in two parts, oblong folio, each 16*s*. (London, Chapman & Hall, 1862.)

Elements of Descriptive Geometry, by J. Woolley, text 8vo., plates 4to., 20*s*. (London, Parker, 1850.)
Elementary Geometrical Drawing, by S. H. Winter, in two 8vo. parts, 3*s*. 6*d*. and 6*s*. 6*d*. (London, Longman, 1861.)
Elementary Treatise on Descriptive Geometry, by J. F. Heather (Weale's series), 12mo., 2*s*. (London, Weale, 1851.)
First Lines in Geometrical Drawing, by J. F. H. De Rheims, 8vo., 9*s*. (London, Williams & Norgate, 1865.)
Hall's Descriptive Geometry. (John Parker, West Strand.)
Practical Geometry, by R. Burchett. (London, Chapman and Hall, 1859.) (For Plane Geometry only.)

The following are most valuable as works of reference on the subject of Descriptive Geometry, but, with the exception of the third, are too diffuse and comprehensive to be used as text-books by the generality of students:—

Traité de Géométrie Descriptive, par J. Adhémar (with Atlas), 8vo. 20*s*. (Paris, 4th ed.)
Essais de Géométrie sur les Plans et les Surfaces Courbes, par S. F. Lacroix. (Paris, 7th ed.)
Traité de Géométrie Descriptive, par Lefébvre de Fourcy, 2 vols., 8vo. (Paris, 1864.)
Traité de Géométrie Descriptive, par La Vallée (with Atlas), 4to., 15*s*. (Paris, 2nd ed., 1825.)
Traité de Stéréotomie, &c., par C. F. A. Leroy, *annotée* par E. Martelet, 4to. (with Atlas in folio). (Paris, 1866.)
Notes et Croquis de Géométrie Descriptive, par Bardin, folio, 10*s*. (Paris, 2nd ed., 1837.)

Appendix to Syllabus of Subject I.

The following brief outline of an elementary course of descriptive geometry is recommended to the attention of students, especially those who depend a good deal upon their own private study, and are consequently uncertain as to what particular points their chief attention should be devoted to.

1. The representation (by its plan and elevation) of a point in space in all the combinations of position of which it is capable (*i.e.*, whether above or below the horizontal plane, before or behind the vertical plane).

2. Having given the plan and elevation of a line, with its extremities situated in given positions with regard to the co-ordinate planes to determine:—

   1°. Its "traces."

   2°. Its true length, and its inclination to each plane of projection.

   Deduction.—To draw the plan and elevation of a line of given length when inclined at $a°$ to the horizontal, $b°$ to the vertical plane.

3. Having given the "traces" of a plane in any position or direction with regard to the "ground line" to determine the inclination of that plane to each plane of projection, and also the real angle contained by those traces.

   Note.—In all cases where traces of a plane are concerned, the student will find his comprehension greatly assisted by the aid of a paper diagram or model, thus:—If he draws a ground line on a piece of paper, and the two traces of a plane meeting at some point on that line, and then folds the paper at the ground line, so that the one portion is at right angles to the other (thereby representing the co-or-

dinate planes), he will then very readily see how those two traces determine the position of a plane, and will see more clearly the reason for drawing the various lines necessary to solve the problems on planes given above.

The "deduction" from the above problem, namely, to draw a plane that shall make given angles with the planes of projection, had better not be attempted yet by the beginner.

4. To place in a given plane a line, indefinite or otherwise, having a proposed inclination.

The student should be fully aware of the great advantages obtained by assuming the vertical plane of projection at right angles to the given plane, or, as it appears on paper, by taking the ground line at right angles to the horizontal trace.

5. To draw the plan and elevation of a line at right angles to a given plane.

1°. From a point in the plane to be of given length.

2°. From a point outside the plane.

6. Reverting to problem 4:—Draw the plan, &c. of a line a'' long inclined at A°, but lying in a plane inclined at B°, and complete the plan of the square, of which this is one side.

It is scarcely necessary to warn the student against assuming the A° larger than the B°.

In this construction will be introduced the all-important process of "*constructing*" the plane, *i.e.*, turning it round upon its horizontal trace, as hinge, till it takes up itself a horizontal position, and the points, lines, &c., lying in it, are seen in their true relative positions.

The problem (6) may be infinitely varied as the given "line a'' "long," need not necessarily be a *side* of the plane figure whose plan is to be determined, but any line connected with it.

7. Let the square in the last problem be one of the faces of a cube. With the aid of problem 5 complete the plan of the cube.

The student will have thus arrived at the first case of solids represented under given conditions, the data in this case being the inclination of *a plane*, and the inclination of *a line* lying in that plane. But he must not neglect in his course the study of the simple geometrical solids, when resting on the horizontal plane with one face or the base in contact with it. The cube, tetrahedron, and octohedron, as also the pyramid and prism, should be studied in these positions and sections, or sectional elevations should be determined as formed by planes given in various positions.

8. To find the angle contained by two straight lines which meet (*i.e.*, the projections of the lines being given).

9. To find the angle formed by a given straight line and a plane.

10. To find the angle formed by two intersecting planes.

Deduction. Through a given straight line, lying in a given plane, to draw a second plane, which shall form an angle of A° with the first.

11. Two lines of given length contain an angle of A°. The one is inclined at B°, the other at C°. Draw the plan of the lines in that position, and determine the inclination of the plane containing them.

Memo.—A°, B°, and C° together must not exceed 180°.

12. Two lines, each a'' in length, bisect one another, and are at right angles. The one is inclined at A°, the other at B°. Considering these to be two diagonals of an octohedron, complete the plan of the solid.

The student here arrives at the second important case of solids from conditions, the data in this case being the inclinations of two lines connected with the solid.

This brief course only professes to point out to the student those problems which call for his earliest and most careful attention, either as involving an important principle, or as being the key to other branches of the subject. He will find that after mastering these, that other problems that he may meet with in his examination papers or text-books will have lost much of their apparent difficulty.

Problems with reference to curved surfaces cannot be introduced into a brief syllabus like this, as they cannot well be studied without the aid of an experienced teacher, and, as regards this last remark, the student is recommended constantly to bear in mind that 10 minutes verbal instruction in this subject is worth nearly one hour's private study of a text-book.

SUBJECT II. MACHINE CONSTRUCTION AND DRAWING.

It is assumed that the candidate has already acquired the power of representing objects in orthographic projection, and of drawing to scale (*see* Subject I.), and that he is capable of drawing well and neatly; the examination in this subject then will, besides this, test his knowledge of the form and construction of the elementary parts of machines. Small sketches of machine details will be given, more or less incomplete, with the principal dimensions. The candidate will be required to make from these complete drawings to a given scale. Generally more than one view of each detail will be required, and the several views must be properly projected from each other. The candidate should first set out the centre lines of the drawing and should set off the dimensions from them. The candidate should indicate by diagonal shading the parts cut by planes of section. Any indication that the candidate has merely copied the sketches given, without understanding the principle of the mechanism, will invalidate his examination.

First Stage or Elementary Course.

The candidate will only be required to show an acquaintance with the simplest elements of machines, and the simplest methods of combining parts of machines.

Second Stage or Advanced Course.

The candidate must show a wider and more accurate knowledge than is required for the elementary course, and a power of drawing more complex combinations. He may be required to draw one view of a part of a machine from details given in other views. For instance, a plan from given elevations.

The following list is not intended to be exhaustive, but it indicates the more important parts of machines, with the form and construction of which candidates for the elementary and advanced courses should be familiarised.

Proportions of bolts and nuts; connexion of cast-iron parts by bolts and flanges; connexion of parts by a key; connexion of parts by a cotter, or by gibs and cotter.

Shafting with collars, and bosses. The simpler forms of couplings for shafts. Half lap coupling; box coupling; face plate coupling.

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* The most practical of all French works.

Pedestals and plummer blocks. Forms and proportions of steps. Brackets for carrying shafts.

Spur wheels, bevel wheels, mortice wheels. Pullies for belting. Fast and loose pulley; cone pullies.

Forms of wrought and cast iron crossheads. Of engine connecting rods. Of cast and wrought iron cranks. Of eccentrics.

Construction of steam-engine piston, and of air-pump bucket.

Form and construction of various kinds of valves. Ball valve; conical or puppet valve; flap valve; Indian-rubber disc and butterfly valve; double-beat valve, sliding valve, or sluice.

Glands and stuffing boxes.

Pipes and pipe joints.

Arrangement of simple steam cylinder and valve chest, with steam passages.

Arrangement of simple form of air pump and valves.

Arrangement of simple form of force pump and valves.

Examination for Honours.

The candidate will have to pass an examination designed to test his knowledge of the principles and practice of machine construction, his answers being illustrated, when necessary, by careful hand sketches. He may be examined as to the general construction and principles involved in the action of the most important varieties of steam engines, water-wheels, pumps, presses, and machine tools. He should be acquainted with the forms and most obvious proportions of transmissive machinery, shafting, gearing, &c., and the modes of varying velocity in machines. He should know how, in the simpler cases, to proportion a part of a machine to the load it has to carry. He should have some knowledge of the material of which different parts of machines should be constructed.

In addition the candidate will have to design some portion of an engine or machine from a general description, and to prescribed dimensions. He must show a practical acquaintance with the construction of the machine, and a power of proportioning its parts. He should aim at producing a working drawing. This design the candidate will have to execute at his own home in a specified time.

The following works are recommended as text books and books of reference :—

Rudimentary Principles of the Construction and Working of Machinery, by C. D. Abel, C.E. (Virtue and Co.)

Practical Treatise on Mill Gearing, by Thomas Box. (E. and F. N. Spon.)

Catechism of the Steam Engine, by John Bourne. (Longmans.)

Machinery and Millwork, by Professor J. M. Rankine. (Griffin.)

Treatise on Mills and Millwork, by Sir W. Fairbairn, C.E. (Longmans.)

The Elements of Mechanism, by T. M. Goodeve. (Longmans.)

Der Constructeur von F. Reuleaux. (F. Vieweg und Sohn Braunschweig.)

Le Vignole des Méchaniciens. Essai sur la Construction des Machines. Armengaud. (A. Morel et Cie., Paris.)

SUBJECT III. BUILDING CONSTRUCTION.

As the object of this Course of Instruction is to lay the foundation of a sound knowledge of the principles, as well as of the practice, of Building Construction, and so lead the workman to labour with his head at the same time as with his hands, the teacher should not, necessarily, attempt to push the students through the whole of the subjects enumerated in this syllabus, but should limit the range of his tuition according to the time at his command and the intelligence of the pupils.

A larger number of questions will be set in the examination papers for the Elementary and Advanced Stages, than the candidates will be allowed to attempt, so that he will, to a certain extent, be able to show his knowledge in such branches as he may, from circumstances, have paid special attention to. For instance, a student better acquainted with iron than wooden structures will be able to select a question on iron, in preference to one on wood, work. In order, however, to ensure that special attention shall not be given to work of one description *only*, a certain number of the questions given, about one half, will be compulsory, *i.e.*, the candidate must attempt these, and unless he shows a sound knowledge of work of more than one kind, by answering a fair proportion of them, the rest of his paper will not be considered.

Moderately good drawing, showing an intelligent knowledge of the subject, will always be awarded higher credits at the examination than more highly finished drawings, exhibiting an ignorance of constructive details.

FIRST STAGE, OR ELEMENTARY COURSE.

It is assumed that the student has already mastered the use of the following drawing instruments:—rulers, ordinary and parallel; ruling pen; compasses, with pen and pencil bow-sweeps, as well as the construction and use of simple scales, such as 1, 2, 3, or more feet to the inch, showing inches; or such as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{3}$, $\frac{3}{8}$, $\frac{1}{8}$, or other fraction of full size, or of any given scale or drawing: and the meaning of such terms as Plan, Elevation (front, back, or side), Section, Sectional Elevation.

He should understand the object of bond in brickwork, *i.e.*, English bond, Flemish bond, or English bond with Flemish facing, and how it is attained in walls up to three bricks thick, in the following instances, viz., footings with offsets, angles of buildings, connexion of external and internal walls, window and door openings with reveals and square jambs, external gauged arches (camber, segmental, and semi-circular), internal discharging arches over lintels, and inverted arches.

He should know where to put wood bricks, or plugging, and their use; the construction and uses of brick corbeling, and the construction of trimmer arches in fire-places.

He should be able to give sections and elevations to scale of the following kinds of mason's work, viz., uncoursed and coursed rubble, block in course, and ashlar, with their bond, and the proper dimensions of the stones, as to height, width of beds, and length; and of the following dressings, viz., window sills, window and door jambs, plain window and door heads, door steps, string courses, quoins, copings, common cornices, blocking courses; and of the following methods of connecting stones, viz., by cramps, dowels, joggles, and lead plugs.

He should be able to show how to join timbers by halving, lapping, notching, cogging, scarfing, fishing, and mortise and tenon; as applied to wall plates, roof timbers, floors, ceilings, and partitions.

He should be able to draw, from given dimensions, couple, collar, and kingpost roofs, showing the details of the framing and of the ironwork.

He should be able to draw, from given dimensions, single, double, and framed floors, with or without ceilings beneath them; showing modes of supporting, stiffening, and framing the timbers, trimming round hearths and wells of stairs; also floor coverings of boards or battens, rebated and filleted, ploughed and tongued, and laid folding, with straight or broken joints, beveled or square heading joints.

He should be able to draw in elevation, from given dimensions, a framed partition with door openings.

He should be able to draw in elevation, and give vertical and horizontal sections of solid door frames and window frames.

He should be able to describe, by drawings, beadings of different kinds, dovetailing, cross-grooving, rebating, plough-grooving, chamfering, rounded nosing, and housings.

He should be able to draw in elevation, and give vertical and horizontal sections of, the following doors, viz., ledged, ledged and braced, framed and braced, paneled, and the mode of putting them together, position of hinges and furniture; as well as to describe, by drawing, the following terms as applied to paneled doors, viz., square and flat, bead butt, bead flush, moulded, all on one or both sides.

He should be able to draw in elevation, and to give vertical and horizontal sections of the following window sashes and frames, viz., single or double hung sashes with square, beveled, or moulded bars, and cased frames; casement sashes hung to solid frames, with method of hanging and securing in each case.

He should be able to show, in elevation and section, the lead-work connected wich chimneys, ridges, hips, valleys, gutters, and lead-flats.

He should be able to give an elevation and section of the slating of a roof laid with duchess or countess slates on boards or battens.

He should be acquainted with the proper cross section for cast-iron beams for use in floor girders or bressummers, or as cantilevers; and be able to draw such a section in its right proportions from given dimensions of flanges.

He should be able to draw in elevation, from given dimensions and skeleton diagrams, ordinary iron roofs up to 40 feet span, showing the sections of different parts, and methods of connecting them.

Second Stage, or Advanced Course.

In addition to the subjects enumerated for the Elementary Course—in all of which questions of a more complicated nature may be set, combining work done by the different trades—the knowledge of the students will be tested under the following heads, viz.:—

1st. Freehand sketches explanatory of any details of construction, such as the joints of iron and wooden structures, and other parts requiring illustration on an enlarged scale. These sketches may be roughly drawn, provided they are clear and capable of being readily understood.

2nd. The nature of the stresses to which the different parts of simple structures are subjected, as follows:—

In the case of beams fixed at one end, such as cantilevers, and fixed at both ends, or supported at both ends, as in girders, the student should know which side of the beam is in compression, and which in tension.

He should be acquainted with the best forms for struts, ties, and beams, such as floor joists, exposed to transverse stress.

He should know the difference in the strength of a girder carrying a given load at its centre, or uniformly distributed.

In the ordinary kinds of wooden or iron roof trusses, and framed structures of a similar description, he should be able to distinguish the members in compression from those in tension.

3rd. The nature, application, and characteristic peculiarities of the following materials in ordinary use for building purposes, viz. :—

Bricks of different kinds in common use, York, Portland, Caen, and Bath stones (or stones of a similar description), granite, pure lime, hydraulic lime, Portland and Roman cement, mortars, concretes, grout, asphalte, timber of different kinds in common use, cast and wrought iron, lead.

4th. Constructive details, as follows :—

The ordinary methods of timbering excavations, such as for foundations to walls, or for laying down sewers; the erection of bricklayer's and mason's scaffolding; the construction of travelers; the use of piles in foundations; hoop iron bond in brickwork, diagonal and herring-bone courses in ditto, damp-proof courses, bond timber in walls and the objections to it.

He should know how bricks are laid in hollow walls, window or door openings with splayed jambs, flues, chimneys, fireplaces, and arches up to about 20 feet span; how mortar joints are finished off, and the thickness usually allowed to them; why bricks and stones ought to be wetted before being laid.

He should be acquainted with the construction of brick ashlar walls, rubble ashlar walls, stone stairs, wooden stairs (both dog-legged and open newel), skylights, fire-proof floors (such as brick arches supported on rolled or cast-iron girders, Fox and Barrett's, and Dennett's patent concrete floors), circular and egg-shaped drains, roofs of iron or wood, for spans up to 60 feet; the fixing of architraves, linings and skirtings to walls, shutters to windows, lath, plaster, and battening to walls, roof coverings of tiles and zinc, slate ridges and hips.

Written answers will be required to some of the questions.

Examination for Honours.

The candidate will have to furnish a design for a building, or part of a building, in accordance with given conditions; which design he will be allowed to draw out at his own home.

He will be called upon to answer in writing—illustrated by sketches, either freehand or to scale, as directed—questions on all the subjects previously enumerated for the elementary and advanced Courses.

He must possess a more complete knowledge of building materials, their application, strength, and how to judge of their quality; and in the case of iron, of the processes of manufacture, and the points to be attended to in order to insure sound castings, and good riveting.

He must be able to solve simple problems in the theory of construction, such as in the case of a beam supported at both ends, to ascertain the proportion of the load transmitted to each point of support, and to determine the safe dimensions of iron or wooden beams subjected to dead loads.

In ordinary roof trusses and framed structures of a similar description, he must be able to trace the stresses, brought into action by the load, from the points of application to the points of support, as well as to determine the nature and amount of the stresses on the different members of the truss, and, consequently, the quantity of material required in each part.

In ordinary walls and retaining walls, he must be able to ascertain the conditions necessary to stability, neglecting the strength of the mortar.

Text-books.

	s.	d.
Drawing for Carpenters and Joiners. Davidson. Publisher, Cassell, Petter, and Galpin - - - - - -	3	6

	s.	d.
Building Construction and Architectural Drawing. Davidson. Publisher, Cassell, Petter, and Galpin	2	0
The Art of Building. Dobson. (Weale's Series.) Publisher, Virtue and Co.	1	6
Foundations and Concrete Works. Dobson. (Weale's Series.) Publisher, Virtue and Co.	1	6
Carpentry and Joinery. (Weale's Series.) Publisher, Virtue and Co.	1	6
Plates to ditto. (Weale's Series.) Publisher, Virtue and Co.	4	6
Roofs for Public and Private Buildings. (Weale's Series.) Publisher, Virtue and Co.	1	6
Iron Roofs of recent Construction, descriptive plates. Virtue and Co.	4	6
Masonry and Stone-cutting. Dobson. (Weale's Series.) Publisher, Virtue and Co.	2	6
Limes, Cements, Mortars, Concretes, Mastics. Burnell. (Weale's Series.) Publisher, Virtue and Co.	1	6
Brick and Tile-making. Dobson. (Weale's Series.) Publisher, Virtue and Co.	3	0
Exercises on Mechanics and Natural Philosophy. Tate. Publisher, Longman	2	0

For the General Library.	£	s.	d.
Gwilt's Encyclopædia of Architecture. Publisher, Longman	2	12	6
Tredgold's Carpentry. (New edition in the press.)			
Ashpitel's Treatise on Architecture. Publisher, Black	1	10	0
Newland's Carpenters and Joiners' Assistant. Publisher, Blackie	2	18	0
Nicholson's Carpentry. Publisher, Kelly.			
Reid on Portland Cement. Publisher, Spon	0	12	6
Rankine's Civil Engineering. Publishers, Griffin and Co.	0	16	0
,, Useful Rules and Tables. Publishers, Griffin and Co.	0	9	0
Humber's Handy Book of Strains. Publisher, Spon	0	7	6
Sheilds on Strains in Ironwork. Publisher, Weale	0	5	0

SUBJECT III (ALTERNATIVE).—NAVAL ARCHITECTURE.

First Stage or Elementary Course.

Candidates for the elementary course will be required to possess sufficient knowledge of practical ship-building, to apply the various materials used for that purpose to the greatest advantage, such for instance as "shift of butts" for both wood and iron ships. Also to be able to make sketches, to scale, of the component parts of a ship's hull.

Second Stage or Advanced Course.

Candidates for the more advanced course will, in addition to that directed for the elementary course, be required to make detail and working drawings, showing a knowledge of the methods of combining the several parts of a ship's hull. Also to possess a knowledge of laying off on the mould loft floor.

Examination for Honours.

The honours examination will embrace questions relating to the calculation of displacement, in addition to that prescribed for the preceding courses; and the candidates will be required to make a drawing at home, comprising sheer, half-breadth and body plans, from data which will be furnished.

Neatness and accuracy in drawing will be insisted on.

The following works will comprise all that the teachers will require as text books, viz.:—

Rudiments of Naval Architecture, by James Peake (Weale's Series), 12mo., 3*s*. (London, Weale, 1851.)

Shipbuilding in Iron and Steel, by E. J. Reed, 8vo., 30*s*. (London, Murray, 1868.)

Directions for Laying-off Ships, by J. Fincham, 8vo., 5*s*. (London, Whittaker, 1840.)

Outline of Shipbuilding, by J. Fincham, 8vo., 31*s*. 6*d*. (London, Whittaker, 1853.)

Shipbuilding, Theoretical and Practical, edited by W. J. M. Rankine, folio, 84*s*. (London, Mackenzie, 1866.)

For the General Library: *Barlow's Strength of Materials.*

SUBJECTS IV. & V.—MATHEMATICS.

This subject is divided into seven stages, The examination in stages 1, 2, and 3 is taken on one evening; in stages 4 and 5 on another; and in stages 6 and 7 on a third.

A student may in any one year come up on all three evenings, but he may only take up one stage on each evening. The manner in which the subject has been divided under the several stages has been largely dictated by the requirements of the system of the Department as respects payments on results and method of examination. The sequence of the stages is therefore not to be considered strictly as a guide to the student's reading. There is no reason, for instance, why a student should not read the portion of the subject given under stage 4 at the same time or before that given under stage 3.

N.B.—Sufficient questions will always be given in the early portions of each stage to enable a student with a thorough knowledge of them by good answering to obtain a second class.

First Stage.

A certain number of questions will be set which must be attempted; and no candidate will be allowed to pass unless his answer to those questions shows that he possesses sufficient knowledge of the subject to obtain a correct solution.

1. *Arithmetic generally.*—The performance of numerical calculations with accuracy and lucid arrangement, and explanation of the reasons of processes of a simple kind, may be demanded. This branch is mentioned not so much as a separate subject, but because wherever examples are given which involve *numbers*, the complete solution in figures should be given: that it may be

ascertained by the examiner that the candidate can from formulæ in symbols deduce useful numerical results.

Decimal fractions in all cases to be shown (not *vulgar fractions*).

2. *Geometry.*—The properties of lines, triangles, rectilinear figures, as far as they are treated in the 1st Book of Euclid.

The examination questions in this subject will generally be given so as to bring out as far as possible the candidate's knowledge of the principles of geometry. They will not be set in the form of Euclid, but will consist as far as may be of definitions and easy geometrical theorems which can be proved, and problems which can be solved by the application of the well-known properties of triangles, &c. Any solution, whether in the words of Euclid or not, which shows that the candidate possesses an accurate method of geometrical reasoning will be accepted. Candidates should endeavour to draw good figures, and should as much as possible keep the demonstration on the same page with the figure.

3. *Algebra.*—Definitions. Simple rules. Greatest common measure and least common multiple. Integer Indices. Fractions and Reductions. Simple equations and problems producing them.

Second Stage.

All the preceding subjects, with these additions:—

1. *Geometry.*—The relations of rectangles and squares to one another, and the properties of the circle, as far as they are treated in the 2nd and 3rd books of Euclid.

As before defined, answers to questions on this part of Geometry may be given on any system which the student may have followed, provided the reasoning be clear and accurate.

2. *Algebra.*—Quadratic equations and problems producing them. Involution and Evolution. Ratio. Proportion.

3. *Plane Trigonometry.*—Definitions. Modes of measuring angles, by degrees, grades, and circular measure. The goniometric functions, and the conversion of one into another. The meaning of contrariety of signs in trigonometry. Tracing of the goniometric functions in magnitude and algebraic sign through the four quadrants and when an angle is indefinitely increased. The arithmetical values of the goniometric functions of 30°, 45°, 60°, 75°, 90°, &c.

Formulæ for multiplication and division of angles: sine, cosine, tangent, &c., of $(A \pm B)$, $2A$, $3A$, $\frac{A}{2}$, and $\frac{A}{3}$. Also of A and B in terms of sines and cosines of $\frac{A+B}{2}$ and $\frac{A-B}{2}$.

Logarithms.—Definition. Multiplication, Division, Involution and Evolution by logs. The use of logarithmic tables. Tables of proportional parts for numbers and angles.

Triangles.—Formulæ for cosine of an angle of a triangle in terms of its sides. The relation between sines of angles and the opposite sides; sine, cosine, tangent, &c., of half an angle of a triangle in

terms of sides, and of the sine of an angle. Area of a triangle. Solution of triangles. Heights and distances of inaccessible objects.

THIRD STAGE.

All the preceding subjects, with these additions :—

1. *Algebra.* — Permutations and Combinations. Progressions. The Binomial theorem. Complete theory of indices. The Binomial theorem with any index. The multinomial and exponential theorems. Logarithms and logarithmic series, and construction of tables of logarithms.

2. *Plane Trigonometry.*

Diameters of circles inscribed in and circumscribed about a given triangle. Areas of regular polygons inscribed in and circumscribed about a given circle. Area of a circle. Description and use of vernier and theodolite and sextant. Demoivre's theorem for an integral positive index. Expressions for sine, cosine, and tangent of an angle in terms of the angle. The exponential expressions for the sine, cosine, and tangent of an angle, and resulting series. Solution of quadratic and cubic equations by trigonometry.

Or a student may, in place of the preceding trigonometry, take up the elements of spherical trigonometry. Questions will be given in both subjects, but in this stage the student will not be required to answer questions in both to obtain full marks.

Spherical Trigonometry.

Definitions of great and small circles, angles, and sides of spherical triangles. Relations between the angles and sides of supplemental triangles. The fundamental relations between the trigonometrical ratios of the angles and sides of every spherical triangle. Solution of right-angled, quadrantal, and other spherical triangles. The analogies of Napier and the formulæ of Gauss.

HONOURS.

In the subjects of the three preceding stages of elementary mathematics the principal theorems and their applications are indicated. A well prepared student will know of extensions of these theorems, and their employment in the solution of problems: to enable him to show enlarged reading there will be set on the same evening a paper headed, Examination for Honours.

The subjects being the same, there will be proposed in this paper questions which will be chiefly problems or theorems of the more difficult kind in each part. In algebra, the examples given will require more familiarity with algebraic transformations and include the doctrine of infinite series with extended use of the binomial and its dependent theorems. Indeterminate equations. Method of indeterminate coefficients. Continued fractions. Series. Properties of numbers. In geometry, the questions will chiefly be problems, or may require the aid of trigonometry as well as pure geometry for their complete answer: in trigonometry, besides questions which will exercise the student's

ingenuity and test his familiarity with principles, the subject of angles greater than two right angles, and the relations between trigonometric ratios and all the angles which they indicate, will be included; trigonometric eliminations and transformations and the application of algebra to geometry must be familiar. Trigonometric series and expansions. Construction of the Trigonometric Tables. Formulæ of Verification. Proportional parts, and the calculation of logarithms of trigonometric ratios by series. The properties of regular polyhedrons treated by spherical trigonometry. (Analytical geometry or the equations of the line and circle will not be required, but chiefly the algebraic representation of geometrical ratios.)

The books in which elementary mathematics may be studied are too numerous to be mentioned, but as specimens of good and trustworthy treatises, which may be used with advantage by candidates who have little or no assistance, the following works by Mr. Todhunter may be recommended:—

Algebra for Beginners, 18mo., 2*s*. 6*d*.
(London, Macmillan, new ed., 1867.)
Algebra for the use of Colleges and Schools, 8vo., 7*s*. 6*d*.
(London, Macmillan, 4th ed., 1866.)
Trigonometry for Beginners, 18mo., 2*s*. 6*d*.
(London, Macmillan, 1866.)
Elements of Euclid, 18mo., 3*s*. 6*d*.
(London, Macmillan, new ed., 1864.)
Plane Trigonometry. 8vo., 5*s*. (London, Macmillan, 2nd ed., 1861.)
Spherical Trigonometry. 8vo., 4*s*. 6*d*.
(London, Macmillan, 2nd ed., 1863.)

More advanced students may study with advantage:—

Wood's Elements of Algebra, by T. Lund, 8vo., 12*s*. 6*d*.
(London, Longman, new ed., 1861.)

which contains an abundant supply of examples in Algebra.

Also,—

Arithmetic and Algebra, by Barnard Smith, 8vo., 10*s*. 6*d*.
(London, Macmillan, 7th ed., 1860.)

may be found useful.

Fourth Stage.

Plane Geometry.—Ratio and proportion. The similitude of figures. Proportional division of straight lines. The inscription of regular polygons in circles.

N.B.—A knowledge of the 4th and 6th Books of Euclid's Elements, supplemented by clear notions of the ratio and proportionality of commensurable, as well as of incommensurable magnitudes, will suffice. Correct demonstrations, however, derived from any other source will be accepted.

Solid Geometry.—The properties of straight lines and planes; their intersections, inclinations, parallelism, perpendicularity, &c.

Trihedral and polyhedral angles. Prisms, pyramids, and polyhedrons; their definitions, plane sections, similitude, &c.; their quadrature and cubature.

Elementary properties of the sphere, and of cylinders and cones with circular bases; their plane sections, tangent planes, surfaces, and volumes.

Descriptive Geometry.—Representation of points, straight lines, and planes, by projections and traces on two orthogonal planes. The use of auxiliary projections and rabatments. Graphic solutions of problems concerning straight lines and planes; their intersections, inclinations, &c. Problems on trihedral angles.

Geometrical Conics.—Properties of the parabola, ellipse, and hyperbola deduced by pure geometry from definitions *in plano.*

Fifth Stage.

The preceding subjects of the fourth stage, together with the following:—

Descriptive Geometry.—Problems concerning spheres, cylinders, cones, and simpler surfaces of revolution; their intersections by straight lines, by planes, and by one another; their tangent planes and normals, &c.

Spherical Trigonometry.—Definitions. Great and small circles. Angles and sides of spherical triangles. Relations between the angles and sides of supplemental triangles. The fundamental relations between the trigonometrical ratios of the angles and sides of every spherical triangle. Solution of right-angled, quadrantal, and other spherical triangles. The radii of their in- and circumscribed circles. The analogies of Napier and the formulæ of Gauss.

Co-ordinate Geometry.—Rectangular, oblique, and polar co-ordinates of a point, and transformations from one system of such co-ordinates to another.

Equations of straight lines, and the treatment of questions relative to their intersection, concurrence, inclination, parallelism, perpendicularity, &c.

Equations of circles, their tangents, and normals. Elementary properties of poles and polars relative to the circle. Questions concerning the intersection of circles, and the determination of circles which satisfy given conditions.

The simpler forms of the equations of the parabola, ellipse, and hyperbola, as determined from various definitions of those curves. The equations of their tangents and normals. The principal properties of their diameters, axes, foci, conjugate diameters, asymptotes, poles, and polars.

Discussion of the general equation of the second degree referred to oblique or to rectangular co-ordinate axes.

Co-ordinate Geometry of three Dimensions.—Co-ordinates of a point referred to oblique or to rectangular co-ordinate axes. Direction-angles of straight lines. Inclination of two straight lines. Locus of points whose co-ordinates satisfy a given equation, or two given equations. Equations of planes and of straight lines. Determination of their inclinations, and of the conditions of their parallelism and perpendicularity. Treatment of questions concerning straight lines and planes.

Honours.

In the examination for honours, questions will be proposed whose treatment requires a more extended knowledge of the foregoing subjects, and an acquaintance with more general methods of investigation. In pure geometry, for instance, some knowledge of harmonic, as well as of anharmonic ratios, of the generation of conics by homographic rows of points and pencils of lines, and of the descriptive properties of these curves as thus deduced will be desirable. In co-ordinate geometry,

again, opportunities will be given of exhibiting a knowledge of the use of abridged methods of notation, of homogeneous point-co-ordinates and line-co-ordinates, and of the modes of investigating thereby some of the simpler properties and singularities of higher plane curves.

In co-ordinate geometry of three dimensions a knowledge of the classification and fundamental properties of surfaces of the second order will be demanded.

Text Books.

Amongst the works on the subjects of the 4th and 5th stages which may be read with advantage, the following may be cited:—Dr. Woolley's Elements of Descriptive Geometry; Todhunter's Spherical Trigonometry; Geometrical Conics by Drew, Taylor, or Besant; Dr. Salmon's Treatises on Conics and on Higher Plane Curves; Townsend's or Mulcahy's Modern Geometry; Frost and Wolstenholme's Solid Geometry.

Sixth Stage.

Differential Calculus.—Definitions. Limits. Differential coefficients Differentiation of simple functions, of inverse functions. Successive differentiation of functions of one variable. Taylor's and Maclaurin's Theorems and their simpler applications. Determination of values of functions when indeterminate in form. Differentiation of a function of a function and of implicit functions. Maxima and minima of functions of one independent variable.

Applications of the preceding to the geometry of plane curves referred to rectangular or to polar co-ordinates. Tangents, normals, sub-tangents, sub-normals, asymptotes. Multiple and singular points. Contact and curvature. Tracing of curves. Differential coefficients of arcs and areas of plane curves, and of the surfaces and volumes of solids of revolution.

Integral Calculus.—Meaning of definite and indefinite integration. Integration of the more frequently occurring functions. Integration by parts. Rational fractions. Formulæ of reduction.

Applications to the rectification and quadrature of plane curves referred to rectangular and polar co-ordinates, as well as to the quadrature of surfaces of revolution.

Seventh Stage.

Differential Calculus.—In addition to the subjects of the sixth stage, the following:—Differentiation of functions of two or more independent variables. Lagrange's and Laplace's Theorems. Change of independent variables. Expansion of functions of more than one independent variable. Maxima and minima of such functions. Elimination of functions.

Geometrical applications of the calculus. Involutes and evolutes of plane curves. Envelopes of curves and surfaces. Tangent planes and normals to surfaces. Tangents and normal planes to curves of double curvature. Differential coefficients of the arcs of such curves, as well as of the surfaces and volumes of solids.

Integral Calculus.—Double and triple integrals. Applications of the calculus to the quadrature of curved surfaces and the cubature of solids. Change of variables in a multiple integral. Definite integrals; their differentiation and simpler properties. Definitions

and elementary properties of elliptic integrals and elliptic functions. Eulerian integrals. Gamma functions.

Differential Equations.—Their nature, origin, and classification. Integrable forms of differential equations of first order and degree. Integrating factors. Riccati's equation. The methods of integrating differential equations of first order, but not of first degree. Linear differential equations. Integration of them by symbolical methods when the coefficients are constant. Singular solutions of differential equations. Ordinary differential equations with more than two variables. Simultaneous differential equations. The nature and origin of partial differential equations. Integration of the simpler forms.

Geometrical applications to the theory of curved surfaces.

Calculus of Finite Differences.—Nature and object of the calculus. Definitions of its symbols and terminology. Differences of elementary functions. Expansion by factorials. Meaning of generating functions. Relations between successive values and differences. Differences of zero. Meaning of integration. Easy applications of the calculus to interpolation and the summation of series.

Honours.

In the examinations for Honours, the range of subjects will be almost the same; but the questions proposed will be of a higher order of difficulty. A more extended knowledge of the applications of the calculus to the theory of surfaces will also be demanded.

Text Books.

The following works may be read with advantage:—

Dr. Salmon's Higher Algebra, Higher Plane Curves, and Analytic Geometry of three Dimensions.

Boole's Treatises on Differential Equations and on Finite Differences.

Todhunter's Treatises on the Differential, and on the Integral Calculus.

Calcul Differentiel et Integral, par Lerret.

Traité du Calcul Differentiel et Integral, par Bertrand.

SUBJECT VI.—THEORETICAL MECHANICS.

First Stage or Elementary Course.

The student who takes up this course is expected to give clear and full statements of the principles of the science, and to show that he understands them by answering easy questions on their applications. These questions will not demand for their solution a knowledge of mathematics beyond the elements of algebra, mensuration, and geometrical constructions by scales and compasses. The formal proof of theorems will not be required except in the cases specified below:—

A.—*Statics.*

(1.) The composition and resolution of forces and the conditions of their equilibrium, viz., the parallelogram, triangle, and polygon of forces. Parallel forces. The principle of moments.

(2.) Physical properties of solids; hardness, elasticity, tenacity.

(3.) Centre of gravity. Its position in the case of a straight line, parallelogram, circle, triangle, sphere, pyramid, and cone, of uniform density; and in the case of several heavy points.
(4.) Reaction of a fixed point or fulcrum. Equilibrium of a body capable of turning round a fixed point; levers; the balance, and its sensibility; the steel-yard.
(5.) Transmission of force through a rigid body and along a perfectly flexible thread. The single pulley. Simpler combinations of pulleys.
(6.) Reaction of smooth and rough surfaces; the limiting angle of resistance, or angle of repose; the coefficient of friction; the laws of friction.
(7.) Conditions of equilibrium of a body resting under the action of forces on a plane whether smooth or rough, horizontal or inclined; equilibrium of a wall sustaining an oblique thrust; buttresses.
(8.) Stable and unstable equilibrium.
(9.) Unit of work, and horse power; simple questions as to the working power of agents; the modulus of a machine.

B.—*Dynamics.*

(10.) Measure of time, distance and velocity—uniform or variable. The accelerative effect of a constant force, and particularly that of gravity. Relations between space, velocity and time in the case of the rectilinear motion of bodies whose velocities are uniformly accelerated. Composition of velocities.
(11.) Definitions of mass, momentum, moving force and of vis viva, energy or accumulated work. The laws of motion. The absolute unit of force.
(12.) Rectilinear motion of a body under the action of given forces; Atwood's machine; motion on an inclined plane, and in a circle; centrifugal force; time of small oscillation of a simple pendulum. Centre of oscillation of an oscillating body.
(13.) Impulsive forces; velocity after direct impact of spheres; transformation (or loss) of accumulated work in collision.

C.—*Hydrostatics and Pneumatics.*

(14.) Law of transmission of pressure through a fluid; pressure of a fluid against a plane area; the centre of pressure; equilibrium of a reservoir wall.
(15.) Pressure of a fluid on a body wholly or partly immersed. Specific gravity of a solid or liquid; and the simpler cases of its determination. Conditions of equilibrium of a floating body. The metacentre. Conditions of stability of a floating body.
(16.) Experiments which show that air is an elastic fluid; the Magdeburg hemispheres; the cistern barometer; Boyle's experiment. Relation between pressure, temperature, and volume of a gas.
(17.) Well known machines and the principles of their construction; the hydraulic press; the specific gravity balance; the hydrometer; Nicholson's hydrometer; the specific gravity bottle; the ordinary suction and forcing pumps; the syphon; the air pump.

The student should be able, if required, to prove:—

(*a*.) The rule for determining the *magnitude* of the resultant of two intersecting forces, assuming the rule for its *direction*.

(*b.*) The rule for determining the resultant of two parallel forces.

(*c.*) That the sum of the moments of two intersecting forces with reference to any point in their plane, equals the moment of their resultant with respect to the same point.

(*d.*) The rule for finding the centre of gravity of a triangle.

(*e.*) The formulæ for uniformly acclerated rectilinear motion, viz. :—

$$v = V + ft. \qquad s = Vt + \tfrac{1}{2}ft^2. \qquad v^2 = V^2 + 2fs.$$

(*f.*) The formula for the *vis viva* of, or *work accumulated* in a moving body, viz., $\frac{1}{2}mv^2$ or $\frac{wv^2}{2g}$.

(*g.*) That the pressure of a fluid on a body wholly or partly immersed equals the weight of the fluid displaced, and acts vertically upward through the centre of gravity of the immersed part of the body supposed of uniform density.

Second Stage or Advanced Course.

The student who takes up the second or advanced course is expected to be able to prove the fundamental theorems of mechanics, so far as the subject is included in the elementary course, and to work somewhat harder examples; thus :—In the elementary examination he might be asked to explain what is meant by "centrifugal force," and to work an easy example on the formula $F = \frac{mv^2}{r}$; in the advanced examination he might be asked to prove this formula as well as to work a somewhat harder example. He is also expected to understand certain parts of the subject not included in the elementary course, viz. :—

(1.) Properties of statical couples, and proof and applications of the equations of equilibrium of forces acting in one plane.

(2.) Conditions of equilibrium of simple machines when the friction of the parts is taken into account. Inclined plane, wedge, screw, pulleys, bodies capable of turning round an axle of finite radius.

(3.) The principle of virtual velocities and its application to machines in a state of uniform motion. Dynamometers.

(4.) Motion on rough inclined and horizontal planes. Motion of projectiles.

(5.) Moment of inertia. Effective forces. D'Alembert's principle. Resultant of effective forces and work accumulated in the case of a body turning round a fixed line. The fly wheel. The compound pendulum.

(6.) Oblique impact. Centre of percussion. The ballistic pendulum.

(7.) Calculation of heights by barometer. The aneroid barometer.

(8.) Motion of fluids through orifices, pipes, and open channels.

(9.) Capillary attraction.

Examination for Honours.

The details of the course for this examination need not be specified, but it must be understood that the student should be prepared to answer questions on every branch of the subject as usually taught in the higher classes in colleges. In addition to the careful study of the usual textbooks, such as Todhunter's *Analytical Statics*, Routh's or Griffin's *Rigid Dynamics*, Besant's or Miller's *Hydrostatics*, the student will find it very useful to study some work in which the subject is treated from a some-

what less exclusively mathematical point of view, such as the first 19 chapters of Jamin's *Cours de Physique*, Morin's *Notions fondamentales de Mécanique*, the first division of Thomson and Tait's *Natural Philosophy*, &c. The applications of abstract mechanics to questions of construction, &c. can be studied in Moseley's *Mechanical Principles of Engineering and Architecture*, and in Rankine's *Applied Mechanics*. It cannot be too strongly impressed on the student's attention that the study of the higher branches of mechanics can only be attempted with profit when it is preceded by a thorough knowledge of the elements; of so much, for instance, as is comprised in the first and second courses.

TEXT BOOKS.

As text books for the elementary and advanced courses the following are recommended:—

(*a*). For Statics and Dynamics:

Mechanics for Beginners, by I. Todhunter, 18mo., 4*s*. 6*d*. (London, Macmillan, 1867.)

Elementary Statics and Dynamics, by H. Goodwin, 12mo., 6*s*. (London, Bell and Daldy.)

Elementary Introduction to Practical Mechanics, by J. F. Twisden, 8vo., 10*s*. 6*d*. (London, Longman.)

(*b*). For Hydrostatics and Pneumatics:—

Manual of Hydrostatics, by J. A. Galbraith and S. Haughton, 12mo., 2*s*. (London, Longman.)

Elementary Hydrostatics, by W. H. Besant, 12mo., 4*s*. (London, Bell and Daldy.)

It will, of course, be understood that the student will in most cases find it best to master one text book in each subject, and then, if he find it necessary, refer to others for information on particular points. He will find it instructive to read attentively the parts of either of the following books which treat of the present subject:—

An Introduction to the study of Natural Philosophy, by C. Brooke, 12mo., 12*s*. 6*d*. (London, Churchill.)

Ganot's Experimental and Applied Physics, translated by E. Atkinson, 8vo., 15*s*. (London, Longman, 3rd ed., 1868.)

For the course for the honour examination the following works may be recommended:—

Analytical Statics with numerous examples, by I. Todhunter, 8vo., 10*s*. 6*d*. (London, Macmillan, 3rd ed., 1866.)

Dynamics of a System of Rigid Bodies, by E. J. Routh, 8vo., 10*s*. 6*d*. (London, Macmillan, 1860.)

Treatise on the Motion of a Rigid Body, by W. N. Griffin, 8vo., 6*s*. 6*d*. (London, Parker and Son, 1847.)

Treatise on Hydro Mechanics, by W. H. Besant, 8vo., 10*s*. 6*d*. (London, Bell and Daldy, 2nd ed., 1868.)

Elements of Hydrostatics and Hydrodynamics, by W. H. Miller, 8vo., 6*s*. (Cambridge, Deighton, 4th ed., 1850.)

The student's attention will in the first place be mainly directed to the above text books, but it will be a great advantage to him to be able to consult some or all of the following works, and to study parts of them, viz.:—

Lectures on Natural Philosophy, by Thomas Young.

Cours de Physique de l'Ecole Polytechnique, par J. Jamin, 3 vols., 8vo., 1*l*. 8*s*. 6*d*. (Paris, Mallet-Bachelier, 2nd ed.)
Treatise on Natural Philosophy, by W. Thompson and P. G. Tait, Vol. I., 8vo., 24*s*. (Oxford.)
Poinsot's Elément de Statique, 8vo., 1 vol.
Poisson Traité de Mécanique, 8vo., 2 vols.
Poncelet, Introduction à la Méchanical Industrielle, 8vo., 1 vol.
Notions fondamentales de Mécanique et données d'expérience, par A. Morin, 5 plates, 8vo. (Paris, Hachette, 1860.)
Mechanical Principles of Engineering and Architecture, by H. Moseley, 8vo., 24*s*. (London, Longman.)
Manual of Applied Mechanics, by W. J. M. Rankine, 12*s*. 6*d*. (London, Griffin.)
Collection of Problems in illustration of the Principles of Theoretical Mechanics, by W. Watton, 8vo. (Cambridge.)

SUBJECT VII.—MECHANICS AS AN ART OR APPLIED MECHANICS.

NOTE.—*The Steam Engine is treated as a special subject.* (*See Subject* XXII., p. 137.)

The subject of applied mechanics is here assumed to be the application of mechanical philosophy by the aid of mechanical art. That there are certain mechanical principles existing in nature which are turned to practical account by means of differently constructed mechanical contrivances in order to accomplish a definite object.

This subject therefore embraces, first, the natural laws or principles that have to be applied, and secondly, the means employed for their application. The mechanical means or appliances that are thus employed cover a wide field, and in the most limited sense include the nature and chief characteristics of the materials that are used in mechanical operations to be fashioned into the required forms. The arranging and combining of these forms into a structure, in such a manner that on the application of force certain definite results will be obtained thereby.

From the foregoing definition it will be seen that applied mechanics has a two-fold character, a mechanical art and scientific principles. The first is chiefly founded on a long accumulation of facts originating in the workshop; this practical part will be found the most difficult to teach, because few books have been written on the subject, and there is no book which treats the subject as a whole. On the scientific principles there are many books, but the greater number are too mathematical for the class of elementary students at the present time. If such books however are studied by the teachers, they will be able to explain the nature of the laws upon which facts depend. The teachers are recommended to read the Cantor Lectures on Applied Mechanics given at the Society of Arts in 1869.

This syllabus is arranged for three classes of candidates; the first is elementary in its character, and may be considered as a stepping-stone to the second or more advanced class; it is intended for the guidance

of the first or elementary class of candidates, who will be expected to have a fair knowledge of most of the branches enumerated, and to be able to give a precise and satisfactory answer on any of them, or to make clear well-drawn hand sketches where such may be necessary for explanation.

The second part is intended for those in the more advanced class, who will be expected to have a thorough knowledge of all the subjects referred to in the syllabus for the elementary class, and, in addition, to have a fair understanding of the application of the principles in actual practice.

The third part is intended for candidates coming forward for "Honours examination," who will be expected to have a complete knowledge of the questions referred to in the two former parts of the syllabus, and, in addition, to have some acquaintance with the higher theoretical principles that are required for the close investigation of the foregoing or more practical part of the subject.

As the chief object of these examinations is to foster the education of young men for the practical duties of life in connexion with the engineering and manufacturing industries of the kingdom, it is intended that the examination in applied mechanics shall be in accordance therewith so far as may be practicable.

First Stage, or Elementary Course.

Candidates for the first course will require to have a fair knowledge of the more common materials that are employed in the arts, and likewise some acquaintance with the general principles of the processes by which they are severally changed in their condition and form, in order to adapt them for practical purposes.

The students should have explained to them the leading principles that determine strength as derived from the form or shape of a beam, pillar, &c.; this will greatly facilitate the after teaching.

They should be familiar with the several mechanical powers, and the combination of these powers into simple machines.

They should know the nature of the various mechanical contrivances that have been designed for changing the condition, direction, or rate of motion, as well as the means employed for its regulation by fly-wheels, governors, and such like. This division will embrace toothed gear shafting, cams, fast and loose pullies, endless bands, and all such appliances.

The elementary students ought to be well grounded in the laws which govern matter in motion, viz., force, energy, momentum, &c., and especially in the nature of mechanical "work," which they ought to be able to apply to all the ordinary purposes of mechanical operations, and to work out in arithmetic.

They should know the laws of friction, and be made acquainted with the various means that are resorted to in order to modify its effect in mechanical apparatus.

Second Stage, or advanced Course.

Candidates in the second stage, or advanced course, should have a thorough knowledge of all the subjects laid down for the elementary stage, and in addition should be well grounded in the strength of materials,

and the reasons that determine the selection of certain materials for particular purposes, and have clearly pointed out to them the respective advantages and disadvantages as due to their several characteristics.

They should understand and be able to describe all kinds of common machinery, such as cranes, machines for weighing, a corn mill, a clock, a coffee mill, or other familiar apparatus.

The candidates should have explained to them the nature of a flat surface or perfect plane, likewise of a true circle, and correct measurement, and the means by which such conditions are obtained.

They should be acquainted with the natural laws that govern fluids, such as air and water, and the different kinds of apparatus that have been contrived in order to apply those fluids to the various purposes of civilization. This division will include water-wheels, turbines, water engines, hydraulic apparatus in its various applications to pumping, pressing, cranes, &c., air blowing, bellows, fan, Roots blower, air compressing and exhausting apparatus, and the usual operations to which they are severally applied.

They should know the general principles of mechanical construction in the engineering workshops, and the operations in connexion therewith, both of the foundry and smithery; likewise the principles upon which the various tools and implements depend for their efficacy.

They should have some acquaintance with the leading manufactures of the country, such as iron and steel, cotton, paper, and printing, and be able to give a fair description of the several processes, as well as the principles upon which they depend.

Examination for Honours.

The foregoing syllabus will sufficiently indicate the nature of subjects that will form the basis for the Examination in Honours in Applied Mechanics. It will be expected, however, that the candidate, in addition to being able to give an intelligent answer to the various questions, and to make hand sketches of such parts as may be required, shall be thoroughly grounded in the laws of nature, so far as they relate to the philosophical and mathematical principles on which the various branches of applied mechanics are founded, and the candidate should not only be familiar with the formulæ, but should be able to refer back to the data from which they are derived.

The following books are recommended for the study of the elementary class of students:—

Exercises on Mechanics and Natural Philosophy, by Thomas Tate. (Longman.)
Elements of Mechanism, by T. Baker, C.E. (Weale's Series.)
Rudimentary and Elementary Principles of the Construction and of the Working of Machinery, by C. D. Abel, C.E. (Weale's Series.)

For the advanced class the following books are recommended:—

Elements of Mechanism, by T. M. Goodeve. New edition.
The Power of Water, by Joseph Glynn, F.R.S. (Weale's Series.)
Useful Information for Engineers, by Sir W. Fairbairn, Bart.
Mills and Millwork, by Sir W. Fairbairn, Bart.
Ganot's Elementary Treatise on Physics.

Students for honours should read :—

Enquiry and Experiments on the Strength of Wrought-iron and Steel, by D. Kirkaldy.
Treatise on the Strength of Materials, by Peter Barlow.
Machinery and Millwork, by Professor Rankine.

The following are books of reference for all classes of students :—

Turning and Mechanical Manipulation, by C. Holtzapffel.
Engineer and Machinist's Assistant. (Blackie.)
Useful Metals and their Alloys. (Houlston.)
Moulder's and Founder's Pocket Guide, by F. Overman.
On the Management of Steel, by G. Ede.

SUBJECT VIII.—ACOUSTICS, LIGHT AND HEAT.

First Stage or Elementary Course.

Questions will be confined to the following subjects :—

Acoustics.

The pupil ought to have a perfectly clear notion of the manner in which a *wave* is propagated.

He ought to know what is meant by the terms density and elasticity as applied to air and other bodies, and how heat and cold affect the density and elasticity of air.

He ought to be able to describe simple experiments to prove that air possesses both weight and elasticity. He ought to understand the law of Marriotte, the construction and use of the air pump, and what occurs when a sounding body is placed in a space from which the air has been withdrawn.

He ought to be taught to see the play of elasticity in the propagation of a sonorous wave through air, and to have a clear mental image of the condensation and rarefaction which make up such a wave. He must, of course, be able to distinguish between the motion of a wave and the motion of the particles which at any moment form the wave.

He ought to know how the velocity of a wave is affected by a change of density, by a change of elasticity, or by a change of both.

He ought to know the velocity of sound in air of the freezing temperature, and also the amount of augmentation of velocity for every degree of the thermometer. The temperature of the air being given, he ought to be able to calculate the velocity of sound through it, and the velocity of sound being given he ought to be able to calculate the temperature of the air.

No doubt or confusion must rest within his mind regarding the meaning of the terms *velocity*, *intensity*, and *amplitude*. He ought also to know the relation of the two last to each other.

He ought to know the laws of the reflection of sound by tubes and mirrors, and to be able to apply his knowledge to the explanation of echoes.

The law of inverse squares as applied to sound, ought also to be explained to the pupil.

He ought to be able to figure mentally the propagation of a sound-wave through solids and liquids as clearly as through air; to know the velocity of sound through water, and to be able to infer from this the relation of the density of the liquid to its elasticity.

He ought to know how the velocity of sound through air has been determined, and to be well exercised in the calculation of distances by means of light and sound.

The pupil ought to know the physical difference between music and noise, and to be able to state the conditions on which the pitch and the intensity of musical sounds depend. He ought also to be able to describe various methods of producing musical sounds.

He ought to have clear ideas of the *length* of a wave, and of the *time* of a vibration. The length of a wave at a definite temperature being given he ought to be able to calculate the time of a vibration, and the time of a vibration being given he ought to be able to calculate the length of the wave.

He ought to be able to describe a method of determining from the pitch of a sound the number of vibrations per second which produce it.

He ought to know the structure of the drum of the ear, including the membranes that close it, and the bones that cross it.

He ought to know the laws of the vibration of strings, and to understand the use of sound boards in stringed instruments.

He must have a clear notion of the formation of *nodes* upon a string, by the coalescence of direct and reflected waves.

He ought also to know the laws of vibration of columns of air in both stopped and open pipes. The exact condition of the air when the fundamental notes of each class of pipes is sounded, ought to be clearly present in the pupil's mind.

The cause of beats in music ought also to be explained to the pupil, and he ought to know the range of the human ear for musical sounds.

Light.

Before entering upon the subject of light, the teacher will have been careful to make his pupil perfectly familiar with the conception of waves of sound impinging upon the tympanic membrane, and the transmission of the tremor thus produced to the auditory nerve. He need not attempt to enter upon the details of this transference to the nerve, but up to the tympanic membrane, and including it, the idea formed by the pupil of sound waves and their action must be perfectly distinct. In all cases an image must exist corresponding to the teacher's words.

He must understand that the sensation of light is caused by something that hits the optic nerve. That this something, whatever it be, passes through the humours of the eye to reach the nerve behind. The conception of light known as the emission theory can afterwards be made clear to the pupil. According to this theory a ray of light would be a train of these particles.

That a ray of light proceeds in a straight line must be made known to the pupil. In connection with this point the inversion of objects by rays passing through small apertures must be explained.

The mode of determining the velocity of light by the eclipses of Jupiter's satellites must be explained to the pupil.

The law of inverse squares must be illustrated.

The cause of shadows and penumbræ must be explained.

The mode of determining the relative intensities of two lights by means of the "shadow test" must be explained.

The reflection of light from plane mirrors must be explained.

The pupil's attention must be drawn to the lateral inversion of objects by plane mirrors. He must know how the distance of an image behind a looking glass is affected by a change of position of the glass in a direction perpendicular to its own planes.

The relation between the angular velocity of a reflected ray and the mirror that reflects it must be explained to the pupil. The multiplication of images by angular mirrors ought also to be explained, and from it the appearances of the kaleidoscope rendered intelligible.

The formation of images by a concave spherical mirror ought to be explained to the pupil. The axis, principal focus, and centre of the mirror are to be pointed out. Beginning with a luminous point placed beyond the centre, and upon the axis, the successive positions of the image of this point during its motion along the axis from a great distance through the centre through the principal focus, up to the surface of the mirror itself must be determinable by the pupil. He will then be taught to determine the position of the images of points not placed on the axis. Objects of sensible dimensions, such as the pupil's own body, must then be substituted for points. (The teacher will avail himself of such simple apparatus as he can command in the explanations here referred to; a silver spoon, if he possesses nothing better, will be useful.)

Real and *virtual foci* are to be defined.

The "aberration" of a large spherical mirror must be explained.

The refraction of light must be explained. By means of a simple geometrical construction the meaning of the "index of refraction" may be explained to the pupil without the introduction of the term "sine."

It must be clearly explained that an object looked at with a single eye appears more near the greater the divergence is of the rays which reach the eye from the various points of the object. From this it will be inferred that a lake or river, the bottom of which is visible, appears more shallow than it really is.

Various simple, but instructive illustrations of the effects of refraction will occur to the teacher, such, for example, as the rendering of a coin visible by pouring water into a basin, and the apparent bending of a straight stick thrust obliquely into water.

The circumstances under which *total reflection* occurs must be clearly explained to the pupil.

The power and action of lenses must be explained; the teacher will define the *principal focus* of a lens. As in the case of a spherical mirror, he will begin with a luminous point, determining the position and character of its image, while it moves from a great distance up to the lens itself. He will pass from points to objects of sensible dimensions, and show how the position of the image of every point of such object may be determined.

Here also *real* and *virtual foci* are to be explained.

The explanation of the magic lantern is then to be introduced.

It would add much to the efficiency of the instruction if the teacher would illustrate the points here referred to by common spectacle lenses, provided he has nothing better.

The pupil in the first class is also in a condition to know what is meant by the spherical aberration of a lens.

He must understand the optical structure of the eye, be able to give a clear account of the conditions of distinct vision, and of the causes and remedies of long and short sight.

He ought to be acquainted with the fact that impressions persist upon the retina, and to know what is meant by irradiation.

He ought to know the principles of binocular vision, and to clearly comprehend how the impression of solidity is produced by the stereoscope.

He ought to be made acquainted with the composite character of white light; and to be able to describe an experiment by which such light may be resolved into its coloured constituents.

He ought to understand the doctrine of colours as far as they are produced by absorption.

And he ought to understand the meaning of *chromatic aberration.*

Finally, it is to be stated to the pupil that according to our best knowledge the sensation of light is not produced by the impact of little particles darted out from luminous bodies; but that it is caused in a manner somewhat similar to the sensation of sound, namely, by the successive shocks of minute waves against the retina.

Heat.

The pupil should know the general effect of heat upon the volumes of bodies, and should be able to describe experiments illustrative of the expansion of solids by heat. He ought also to have an idea of the almost irresistible force of this expansion.

He ought to understand with perfect clearness what is meant by the *coefficient of expansion,* linear, superficial, and cubical.

He ought to know by heart the coefficients of expansion of gold, silver, platinum, iron, and glass; and the reason why it is possible to fuse platinum wire into glass without fracture on cooling.

He ought to know the principle of Breguet's metallic thermometer, and to be made acquainted with some of the precautions which changes of volume by heat and cold render necessary in the arts.

He ought to be able to describe and explain the gridiron pendulum.

He must be able to describe the construction and explain the use of of the mercurial thermometer; the scales of Fahrenheit, Celsius, and Reaumur must be known to him, and he must be able to convert immediately the readings of any one of them into those of the other.

The dependence of the boiling point of water upon external pressure ought to be known, and the pupil must be able to give illustrations of this dependence.

He ought to know by heart the coefficients of expansion of water, alcohol, and mercury.

The pupil must be well acquainted with what is called the *maximum density* of water, to state at what temperature it occurs, and to point out its effects in nature.

He ought to be acquainted with the change of volume which occurs when water passes from the liquid to the solid state, and to apply his knowledge to the bursting of water-pipes in frosty weather. He ought to be acquainted with the fact that expansion on solidification is not a property peculiar to water.

He ought to be able to describe experiments which shall illustrate the expansion of gases. The principle and action of the fire-balloon ought to be explained to the pupil.

The general principles of ventilation ought also to be known to him, and also the sun's action in the generation of winds. He ought to be able to explain the Trade Winds.

The constancy of the coefficient of expansion of gases ought to be pointed out, with the small deviations from the general rule exhibited by carbonic and sulphurous acids. The chemical and physical character of these gases ought to be known to the pupil.

He ought to know the constitution, chemical and physical, of aqueous vapour, and how it is diffused in the atmosphere. He ought to know the meaning of the term *saturated* as applied to air charged with vapour.

The effect of expansion in chilling air ought to be known to the pupil, and also the condensation of the aqueous vapour diffused through the air in consequence of such a chill.

He ought to be able to see the application of this knowledge to the explanation of clouds and rain.

He ought to have a perfectly clear idea of what is meant by *specific heat* or *capacity for heat*, and to be able to describe the calorimeter of Lavoisier and Laplace. He ought to know by heart the specific heats of water, alcohol, mercury, iron, and lead; and to be made aware of the influence which the high specific heat of water exercises upon climate.

He ought also to be intimately acquainted with the facts covered by the term *latent heat*. Taking a block of ice at a temperature below the freezing point, he ought to be able to describe with perfect accuracy what occurs when the temperature of the substance is raised until it liquifies, boils, and is converted into vapour.

The latent heat of water, as expressed on the Fahrenheit and centigrade scales, ought to be in the pupil's memory.

The cold of evaporation and its effect in freezing water in the cryophorus ought to be known to the pupil.

He ought to be exercised in calculations on the changes of temperature due to the mixture of steam and water in various proportions.

The pupil ought to know what is meant by the *conduction* of heat, and must be able clearly to distinguish it from the distribution of heat by *convection*. He ought to know by heart the numbers expressing the relative conductivity of gold, silver, copper, iron, and lead.

He ought to be acquainted with the low power of conduction of organic substances; to know the effect of mechanical texture on the transmission of heat, and to explain the function of clothes in preserving the body from cold.

He ought to be acquainted with the character and phenomena of combustion; to be able to explain the chemical actions which occur in the combustion of coal and of ordinary gas, and to explain the manner in which a candle flame receives its supply of combustible matter.

The combustion of the diamond and Newton's prediction regarding it ought to be known to the pupil. That animal heat is due to slow combustion ought also to be made known.

The structure of an ordinary gas flame ought to be pointed out, and the cause of the difference between this flame and that of a Bunsen's burner explained.

The pupil must be acquainted with the general phenomena of *radiant heat*. The similarity between the phenomena of radiant heat and those of light, as regards reflection and refraction, ought to be known to the pupil.

The different powers possessed by different substances to radiate heat ought to be pointed out, and this knowledge ought to be applied in

explaining the striking fact that the cooling of a vessel may, under certain circumstances, be hastened by surrounding it with flannel.

The reciprocity of radiation and absorption ought to be known to the pupil.

He ought also to know what is meant by the term *diathermancy*, and to be able to point how this property is manifested by different bodies.

Second Stage or Advanced Course.

Questions may be set in all Subjects enumerated under the Elementary Stage, and in addition on the following topics:—

Acoustics.

The second course in acoustics includes an intimate knowledge of all the subjects mentioned in the first. In addition to this a knowledge of the following subjects will be required:—

The augmentation of the velocity of propagation of a wave of sound through air by the condensation and rarefaction of the sound wave itself.

Harmonic tones, their generation and their function in music.

The laws which regulate the transverse vibrations of rods.

The vibrations possible to a tuning fork, a disk, and a bell.

The formation of Chladni's figures.

The laws which regulate the longitudinal vibrations of strings and rods. By a comparison of the notes emitted by a rod and a column of air the pupil ought to be able to determine the relative velocities of sound through both substances.

The conditions and cause of resonance ought to be known to the pupil.

He ought also to know how sounds are produced by the vocal organs of man, and to see clearly the similarity between such sounds and those of the syren. As a case of the same kind, the construction and explanation of the Eolian harp ought also to be known to the pupil.

He ought to be well acquainted with the principles of interference as applied to sound.

He ought to be acquainted with the principles of harmony, to know the ratios of the vibrations corresponding to the notes of the gamut, to be able to give a clear account of the bearing of interference upon the question of consonance or dissonance, and to explain why those ratios which are represented by small whole numbers correspond to the most perfect harmony.

Light.

The candidate in the second course must be intimately acquainted with all the subjects mentioned in the first.

He must be able to apply his knowledge of total reflection to the explanation of the mirage of the desert.

He must be able to describe experiments by which white light may be produced by the admixture of its constituents.

He must know what is meant by *achromatism*.

He must be able to give a clear description of the undulatory theory, and to state how the colours of the spectrum are accounted for by that theory.

He must be able to define a ray of light in accordance with the undulatory theory.

He must be able to show how the reflection and refraction of light occur according to the undulatory theory.

He must be able to describe the appearances presented when incandescent metallic vapours are analysed by the prism. Especially must he be able to state what occurs when a sodium flame is thus analysed.

He must also be able to state what occurs when white light is transmitted through a sodium flame, and he must be able to describe an experiment which shall render manifest what occurs.

He must be able to state generally the relation that subsists between radiation and absorption by gases and vapours.

The lines of Fraunhofer must be known to the pupil, and from this knowledge in conjunction with the knowledge demanded by the foregoing paragraphs, he must be able to infer the probable constitution of the sun.

The pupil ought also to know the principles of interference as applied to light.

He ought to be able, in accordance with these principles, to account for the colours of thin plates and of striated surfaces.

The general principles of diffraction ought to be known to the pupil.

He ought to know what is meant by plane polarised light; to describe the act of polarisation in the language of the undulatory theory.

He ought to know what occurs when a beam of light is transmitted through a crystal of Iceland spar; and to describe the state of the emergent light as regards polarisation.

He ought to be able to describe the effects observed when light is transmitted through two plates of tourmaline cut parallel to the axis of the crystal.

He ought to be able to describe some form of the polariscope, and to state and explain by the principles of interference what occurs when a thin plate of selenite is placed between the polariser and analyser.

Heat.

The candidate in the second course must be intimately acquainted with all the subjects introduced into the first.

He ought to be able to give a clear statement of the *mechanical theory* of heat as distinguished from the *material theory*.

He must know what is meant by the "mechanical equivalent of heat," and how it has been determined.

He must know what is meant by specific heat at constant volume and at constant pressure, and to have in his memory the numerical ratio of the two specific heats.

He ought to be able not only to explain the meaning of the difference between the two specific heats in accordance with the mechanical theory, but also to show how from this ratio the mechanical equivalent of heat may be determined.

Given the weight and velocity of a moving body he ought to be able to calculate the amount of heat generated by the stoppage of the motion.

He ought to be able to apply the conceptions of the mechanical theory to the phenomena of combustion.

He ought also to be able to show the bearing of the theory upon the phenomena of specific and latent heat.

Examination for Honours.

The candidate for honours must be intimately acquainted with the foregoing two courses. He must also show himself practically acquainted with the apparatus employed in acoustics, light, and heat.

Text Books.

The following are recommended as text books:—

The Elements of Natural Philosophy, by C. Brooke and Golding Bird, 12mo., 12*s.* 6*d.* (London, Churchill, 6th ed., 1867.)

Ganot's experimental and Applied Physics, translated by E. Atkinson, 8vo., 15*s.* (London, Longman, 2nd ed., 1867.)

Handbook of Natural Philosophy, by D. Lardner. 4 vols., 12mo., 20*s.* (London, Walton, 1856.)

Elementary Treatise on Heat, by Balfour Stewart, 12mo., 7*s.* 6*d.* (London, Macmillan, 1866.)

Heat a Mode of Motion, by J. Tyndall, 8vo., 10*s.* 6*d.* (London, Longman, 3rd ed., 1868.)

A Course of Eight Lectures on Sound, by J. Tyndall, 8vo., 9*s.* (London, Longman, 1867.)

Familiar Lectures on Scientific Subjects, by Sir J. Herschel.

Notes of a Course of Lectures on Light, by J. Tyndall, 1*s.* in printed wrapper; 1*s.* 6*d.* in cloth. (London, Longman.)

SUBJECT IX.—MAGNETISM AND ELECTRICITY.

First Stage or Elementary Course.

Magnetism.

It is exceedingly desirable that the pupil's ideas of the fundamental facts and principles of magnetism should be as clear as our knowledge and his capacity can make them.

He ought to be made acquainted with the action of the natural magnet or loadstone on small pieces of iron. This is to be mentioned to him as the first fact observed, but for the explanation of which other facts are necessary. The action of two natural magnets upon each other ought to be described, and through this action a clear notion of the doctrine of *magnetic polarity* ought to be conveyed to the pupil's mind.

The power of the natural magnet to confer its own magnetic properties upon steel, and the action of the natural magnet on the steel which it has magnetised, ought to be explained.

The action of two pieces of magnetised steel upon each other ought to be made clear, and from this action the fundamental law that like poles repel each other, and that unlike poles attract each other, ought to be deduced.

The distribution of magnetism in a bar magnet ought to be made clear. The effect of breaking the magnet into two halves; the effect of again breaking these halves; and through facts of this nature, a clear idea is to be conveyed that each molecule of the magnet is itself a magnet; the action of the magnet as a whole being the sum of the actions of its molecules.

It is of exceeding importance that the pupil should be taught to connect the facts of magnetism by means of the provisional conception known as *the theory of magnetic fluids*. The teacher will assure himself that a correct image of this theory is in the pupil's mind. He will at the same time be careful to inform the pupil that the theory is an image merely, which enables him to connect and classify his facts, and that it is not a proved scientific truth.

The theory is to be applied in explaining the difference between iron and steel as regards their power of accepting and retaining magnetism. The term *coercive force* and all that relates to it will here come under review.

The theory is also to be applied in explaining the first observed facts of magnetism, including in them, and illustrating by them the general phenomena of magnetic induction, or magnetisation by influence. Every student ought to have a clear image of the state of a piece of iron acted on by a magnet, and he ought to be able to explain why the attraction of the iron is a consequence of that state. He ought clearly to see that repulsion as well as attraction is at work, the resultant attraction being the difference of both.

He ought to understand that when the attracting magnet is very distant, the difference between attraction and repulsion is so small as to be imperceptible; this knowledge will render it easy for him to comprehend why the magnetic poles of the earth which give *direction* to a magnetic needle are incompetent to produce a motion of translation.

The pupil ought to know the facts of terrestrial magnetism; why it is that we consider the earth a magnet. It will be possible to make him acquainted with all that is known regarding the position of the earth's magnetic equator and of the terrestrial magnetic poles.

The terms declination (variation), inclination (dip), and magnetic intensity, ought to be explained to him.

Frictional Electricity.

Here also care must be taken to imprint the fundamental facts and principles clearly and firmly upon the pupil's mind. It is easy in the case of frictional electricity to let the pupil actually see some of the facts; and it is exceedingly desirable that he should do so. The same remark applies to the elementary facts of magnetism.

As in the case of magnetism, the fact first observed, namely, the attraction of light bodies by rubbed amber, must be shown to need other facts for its explanation.

The mode of exciting bodies by friction is to be described; the action of rubbed and unrubbed vitreous bodies upon each other; the action of rubbed and unrubbed resinous bodies upon each other; and the action of vitreous bodies upon resinous bodies, and the reverse, are to be clearly described and illustrated. From these facts the law is to be deduced that bodies similarly electrified repel, and dissimilarly electrified attract, each other. The pupil ought to know why the terms vitreous and resinous, as applied to electricity, have been abandoned.

Having been made acquainted with the elementary facts and principles, the pupil is to be rendered familiar with the provisional conception called the theory of electric fluids.. As in the case of magnetism, he is to understand that this theory is an image merely, and not a truth.

He ought to be made acquainted, by experiments performed or described, with the qualities of insulation and conduction. He ought to know the reason of the old division of bodies into electrics and non-electrics, and also the unsound character of this classification.

Clear definitions ought to be given as to what is to be understood by positive and what by negative electricity. The pupil must be able to determine the quality of the electricity with which any body is charged.

He must be thoroughly versed in the phenomena of electric induction, and must be able to apply the theory of electric fluids in the explanation of these phenomena. In connexion with the subject of electricity this is the most important part of the teacher's duty, for upon a knowledge of the facts and principles of electric induction the comprehension of almost all that follows it depends.

The pupil ought to be able to construct, or describe the construction, of an electrophorus, and to explain its action by reference to the principles of electric induction.

He ought to be able to explain the condenser by reference to the same principles.

He ought to be able to explain the charging and discharging of the Leyden jar by reference to the same principles.

He ought to be able to describe the charging of the prime conductor of an electric machine by reference to the same principles.

The knowledge implied in the last three questions embraces that of the construction of the condenser, the Leyden jar, and the electric machine. The first form of the Leyden jar ought to be known to the pupil.

The distribution of electricity on the surfaces of conductors is to be made known, and from it the power of points to disperse electricity ought to be deduced. The pupil ought to realise that in virtue of its self-repelling character an electric fluid always moves to the external surfaces of bodies. The power of flames in dispersing electricity ought also to be made known to the pupil.

He will now be ready to understand the form and theory of lightning conductors.

The physiological, deflagrating, and mechanical effects of the electric discharge ought to be known to the pupil. He ought also to be able to apply his knowledge to the explanation of thunder and lightning, and of the return shock.

Voltaic Electricity.

The simplest combinations for the generation of a voltaic current ought to be made known to the pupil. The electric state of the free ends of the two metals immersed in the exciting liquid ought to be described; he ought to be taught to apply the theory of electric fluids to the conception of two currents flowing in opposite directions, and then the omission of one of these currents as a matter of convenience ought to be made known.

It is very important that the pupil should have a clear physical image of the fundamental phenomena before his mind. As in cases formerly referred to, the teacher will be careful to explain that this idea of a fluid flowing in a current is an image merely, and not a proved truth.

Galvani's experiment with the legs of the frog which he suspended by a copper hook on an iron railing ought to be explained; and also the experiment of Sulzer, where the tongue is placed between two metals.

The bearing of the experiment illustrating "the return shock" on Galvani's first observation ought to be explained.

The idea of an electro-motive force separating the two electricities and driving them in opposite directions ought to be distinct in the pupil's mind.

He ought to be made acquainted with the magnetical effects of the circuit, with the action of a current upon iron filings, with its action upon a freely suspended magnetic needle. In this latter action he is to be particularly well versed, so as to be able immediately from the deflection of the needle to infer the direction of the current, and from the direction of the current the deflection of the needle.

He must know the action of a current upon a bar of iron placed within a coil round which a current circulates. He must understand the magnetic properties both of the coil and of the bar.

He ought to be made acquainted with the simplest form of the multiplying galvanometer.

He ought to understand the principles of the needle telegraph.

Some of the chemical effects of the current ought to be made known to the pupil. He ought, for example, to have a distinct notion of the composition of water, and an equally distinct notion of its decomposition by the electric current.

SECOND STAGE OR ADVANCED COURSE.

Magnetism.

The more advanced pupils that undertake the second course ought to be intimately acquainted with all the subjects introduced into the first. The following additional subjects are to be mastered.

The disposition of the so-called magnetic curves round a bar magnet, round two bar magnets with similar or unlike poles adjacent to each other, and round a horse-shoe magnet, must be clearly understood. The pupil must know how a short magnetic needle, or of a short bar of iron freely suspended acts in relation to those lines, and he must be able to show that the lines are deducible from the doctrine of magnetic polarity combined with elementary mechanical conceptions.

He must be able to figure mentally the magnetic curves of the earth, and to see their relation to the line of dip.

He must have perfectly clear notions as to what is meant by the strength of a magnet. He must be able to compare the strength of magnets together, by the method of oscillation, by the torsion balance, or by the deflection of a small magnetic needle.

A knowledge of the principles and use of the torsion balance is quite essential.

He must know what is meant by the law of inverse squares, and be able to show how it has been experimentally demonstrated.

The pupil must be acquainted with the effect of temperature and of percussion upon a magnet.

He must know the meaning of the terms horizontal intensity, vertical intensity, and total force. He ought also to know what is meant by the variation of all of those, that they are different at different parts of the earth's surface, at different hours of the day, at different seasons of the year. To a knowledge of the diurnal and annual variations, he ought to add a knowledge of the secular variation.

Frictional Electricity.

The more advanced pupil must be intimately acquainted with all the subjects introduced into the first course.

He must understand the cascade arrangement of the Leyden battery, as contrasted with the ordinary arrangement.

He must understand the application of the torsion balance to the measurement of electric force.

He ought to be able to think out and describe various new and simple forms of the condenser and the Leyden jar.

He ought to be able to carry forward the idea of an electric fluid to the conception of a current of such fluid; he ought to be able to describe the chemical and magnetical effects of such a current. He ought to be able clearly to contrast those actions as manifested by frictional electricity with the same actions as manifested by voltaic electricity.

He ought to be able to describe the experimental arrangements necessary to the production of primary, secondary, tertiary, and currents of higher order by the discharge of the electric battery.

He must understand the law of inverse squares as applied to electricity, and clearly comprehend its limitations.

The diurnal variation of atmospheric electricity ought to be known to the pupil.

The application of the unit jar in the measurement of electric charges ought to be known to the pupil.

The terms quantity and intensity (or as it is called by some *density*) as applied to electricity ought to be clearly understood. The relation of the heating power of an electric discharge to its quantity and intensity ought also to be known to the pupil.

Voltaic Electricity.

The more advanced pupil must be intimately acquainted with the subjects mentioned in the first course.

To the electro-magnetical knowledge there demanded he is to add the knowledge of determining the strength of a current by the deflection of a magnetic needle.

He ought also to be able to determine the relative strength of two currents by their chemical action.

He ought to know how the magnetism of a bar of iron augments in intensity as the currents which surround it augments in strength.

He ought to know how the *attraction* of iron by an electro-magnet augments as the exciting current is augmented. In this case he ought to see and be able to describe the difference between a piece of soft iron and a piece of exceedingly hard magnetized steel.

He ought to be acquainted with induced currents, their various modes of generation, and their laws of action.

He ought to be able to explain the ordinary madical magneto-electric coil. He ought also to be able to describe Ruhmkorff's coil, and some of the effects obtainable by it.

He ought to be able to sketch a current reverser.

He ought to understand the principles of the astatic needle.

He ought to be able to describe the phenomena of the extra-current.

He ought to be made acquainted with the mutual action of currents upon each other, with the attractions and repulsions which are dependent upon direction.

He ought to know how a coil of copper wire may be suspended so that when a current flows through the wire it shall, like a magnetic needle, obey the directive action of the earth.

He ought to be acquainted with the principles of electro-plating, adding to a knowledge of the decomposition of water a knowledge of other decompositions, by which conducting surfaces may be coated with copper, silver, or gold.

He ought also to be made acquainted with the chemical actions that occur within a voltaic cell when the current circulates.

The arrangement of cells into batteries ought to be described. The pupil ought to be made acquainted with the *pile* of Volta and the *crown of cups*. He ought also to have explained to him the battery of Grove.

The reason for employing two fluids in the cells of this battery ought to be explained.

The dependence of the heat generated on the resistance overcome by the current ought to be made known. He ought to be taught to form as definite a conception as possible of resistance in relation to electromotive force, and to understand the formula which expresses the relation of heat, resistance, and current strength.

He ought to understand the theory of molecular currents, and to be able to apply this theory in explanation of the phenomena of magnetism.

Examination for Honours.

Magnetism.

A candidate who enters the honours examination must be intimately acquainted with the foregoing two courses in magnetism. In addition to this he must be able to show that he has a competent practical knowledge of the apparatus employed. He must show ability in devising and executing experiments, and ought to be able in the presence of the examiner to perform experiments illustrative of any or all of the subjects introduced in the foregoing two courses.

Frictional Electricity.

The candidate ought also to know the facts and principles of diamagnetism. He ought also to be able to describe and explain the deportment of crystalline bodies between the poles of a magnet.

In frictional electricity, besides an intimate acquaintance with both of the foregoing courses, the candidate must possess a competent practical knowledge of the apparatus employed. He must be able to devise and execute experiments in the examiner's presence. He must be intimately acquainted with the experiments with a rotating mirror by which Wheatstone determined the velocity of electricity and the duration of the electric spark.

Voltaic Electricity.

Besides being intimately acquainted with the two foregoing courses, the candidate must have a practical acquaintance with the apparatus employed in voltaic electricity.

He must be intimately acquainted with the laws of Ohm which express the relation of electro-motive force, internal and external resistance, and current strength.

He must be able to apply the principles of the dynamical theory of heat to the heat phenomena of the voltaic current. He must be clearly informed as to the manner in which the heat is distributed within and without the battery.

Text Books.

As a text book, in addition to the works on Physics and Natural Philosophy recommended in the Syllabus of Subject VIII., the following work on Electricity may be used:—

Electricity, by R. M. Ferguson, 12mo., 3*s*. 6*d*.
(Edinburgh, Chambers, 1866.)

Notes of a Course of Seven Lectures on Electrical Phenomena and Theories, by John Tyndall, LL.D., F.R.S., 1*s*. in printed wrapper; 1*s*. 6*d*. in cloth. (London, Longman.)

SUBJECT X.—INORGANIC CHEMISTRY.

First Stage or Elementary Course.

Pupils presenting themselves for examination will be expected to possess a knowledge of the following subjects:—

Definition of chemistry. Simple and compound matter. Different modes of chemical action. Combining weights. Volume weights.

Principles of chemical nomenclature. Symbolic notation. Graphic notation. Chemical formulæ. Chemical equations. Atomicity of elements. Simple and compound radicals. Definition of a compound radical. Classification of all elements into metals and non-metals, into positive and negative elements. Classification according to atomicity.

French and English systems of weights and measures. Conversion of English into French weights and measures. The crith and its uses.

Hydrogen.—Its preparation and properties.

Chlorine.—Preparation of chlorine from hydrochloric acid. Analysis and synthesis of hydrochloric acid. Properties and reactions of hydrochloric acid.

Oxygen.—Its preparation and properties. Allotropic oxygen or ozone. Formation and reactions of water. Preparation and properties of hydroxyl. Compounds of chlorine with oxygen and hydroxyl.

Boron.—How it occurs in nature. Its allotropic modifications. Boric anhydride. Boric acids.

Carbon.—Its preparation and allotropic forms. Preparation and properties of carbonic oxide and carbonic anhydride.

Nitrogen.—Its preparation and properties. Compounds of nitrogen with oxygen and hydroxyl. Compound of nitrogen with hydrogen. Ammonia. Ammonic salts.

Sulphur.—Its properties and allotropic modifications. Compounds of sulphur with positive elements. Compounds of sulphur with oxygen and hydroxyl.

Second Stage or Advanced Course.

In addition to the above subjects, pupils presenting themselves for the advanced examination will be assumed to have received instruction in the following:—

Theory of atoms and molecules. Empirical, rational, and constitutional formulæ. Absolute, latent, and active atomicity. Atomic and molecular combination.

Expansion of gases by heat. Reduction of gaseous volumes to standard pressure and temperature.

Manufacture of hydrochloric, nitric and sulphuric acids. Composition and manufacture of bleaching powder. Theory of bleaching. Suitability of water for domestic purposes. Causes of permanent and temporary hardness in water.

Bromine.—Hydrobromic and bromic acid.

Iodine.—Hydriodic, iodic, and periodic acid.

Fluorine.—Hydrofluoric acid.

Silicon.—Silica. Silicic acid. Silicic hydride. Names and formulæ of some of the more important silicious minerals.

Phosphorus.— Phosphoretted hydrogen. Acids and anhydrides of phosphorus.

Arsenic.—Arsenious and arsenic acids. Arseniuretted hydrogen. Detection of arsenic.

Antimony and Bismuth.—Preparation and properties of their chief compounds.

The monad metals, especially potassium, sodium, and silver. Manufacture of soda-ash.

The dyad metals. Barium, strontium, calcium, magnesium, zinc, cadmium, mercury, and copper.

The chief properties of the following metals:—Gold, aluminium, platinum, lead, chromium, manganese, iron, cobalt, and nickel.

Composition, preparation and properties of the more important compounds of these metals.

Outline of qualitative analysis. Reactions of the principal mineral acids and bases. Course pursued in the application of these reactions to the analysis of a mixture of several acids and bases. In future the examination papers in this division will be so framed as to render a knowledge of qualitative analysis essential to the attainment of a first class.

Examination for Honours.

In addition to the above, candidates are expected to possess a knowledge of the following subjects:—

Theory of normal, acid, and basic salts. Constitutional formulæ of the various acids of phosphorus and other elements. Monatomic and polyatomic molecules.

The phenomena of combustion.—Thermal units. Absolute thermal effect, or total amount of heat evolved by various kinds of fuel and other combustibles. Pyrometric thermal effect, or intensity of heat evolved by combustibles. Translation of absolute thermal effect into its mechanical equivalent. Theory of flame. Source of light in luminous flames. Spectrum analysis, its principles and applications. Relations of specific heat to atomic weight.

The law of the diffusion of gases. The laws of electrolysis. The processes used in the quantitative analysis of the more commonly occurring minerals. A knowledge of qualitative and quantitative analysis is essential to the attainment of a class in honours.

Text Books.

For preparation for examination in the above syllabus, the following works are recommended as text books:—

Lecture Notes for Chemical Students (Vol. I. Inorganic Chemistry), by E. Frankland, 8vo., 4*s*. (London, Van Voorst, 2nd ed., 1870.)

First Principles of Modern Chemistry, by U. J. Kay-Shuttleworth, 8vo., 4*s*. 6*d*. (London, Churchill, 2nd ed., 1870.)

Introduction to Modern Chemistry, by A. W. Hofmann, 8vo., 4*s*. 6*d*. (London, Walton, 1865.)

First Step in Chemistry, by R. Galloway, 12mo., 6*s*. 6*d*. (London, Churchill, 4th ed., 1868.)

Lessons in Elementary Chemistry, by H. E. Roscoe, 18mo., 4*s*. 6*d*. (London, Macmillan, new ed., 1869.)

For the advanced course the following may be used in addition to the above:—

Chemistry, Inorganic and Organic, by C. L. Bloxam, 8vo., 16*s*. (London, Churchill, 1867.)

Manual of Elementary Chemistry, by G. Fownes, 12mo., 12*s*. 6*d*. (London, Churchill, 10th ed., 1868.)

Elements of Inorganic Chemistry, by W. A. Miller, 8vo., 21*s*. (London, Longman, 3rd ed., 1864.)

Chemistry for Students, by A. W. Williamson, 12mo., 7*s*. 6*d*. (London, Macmillan, new ed. 1868.)

Chemistry for Schools, by C. Haughton Gill, 12mo. (London, Walton, 1869.)

Qualitative Analysis, by R. Galloway, 8vo., 8*s*. 6*d*. (London, Churchill, 5th ed., 1870.)

Besides these works the following are recommended for reading and working for honours :—

Second Step in Chemistry, by R. Galloway, 12mo., 10*s*. (London, Churchill, 1863.)

Chemical Physics, by W. A. Miller, 8vo., 15*s*. (London, Longman, 4th ed., 1867.)

Dictionary of Chemistry, and the Allied Branches, by H. Watts, in four Vols., 8vo., 1st Vol., 31*s*. 6*d*., 2nd Vol., 26*s*., 3rd Vol., 31*s*. 6*d*., 4th Vol., 24*s*. (London, Longman, 1863–66.)

Elementary Treatise on Heat, by Balfour Stewart, 12mo., 7*s*. 6*d*. (London, Macmillan, 1866.)

Heat considered as a Mode of Motion, by J. Tyndall, 8vo., 12*s*. 6*d*. (London, Longman, 2nd ed., 1866.)

Quantitative Analysis, Fresenius, translated by A. Vacher. (London, Churchill, 5th ed., 1870.)

List of Books of Reference for General Library :—

Fresenius's Qualitative Analysis, translated by A. Vacher. 7th edition. 8vo., 9*s*. Churchill and Sons.

Ure's Dictionary of Arts, Manufactures, &c. 3 vols. 8vo., 4*l*. 14*s*. 6*d*. Longmans.

English Cyclopædia, Arts and Sciences. 8 vols. 8vo., each 12*s*. Bradbury and Evans.

Muspratt's Dictionary of Chemistry. 2 vols. 8vo., 67*s*. Mackenzie.

Brand's Dictionary of Science, &c. 3 vols. 8vo., 63*s*. Longmans.

Chemical Technology, by Richardson and Watts.

All the vols. of the Cavendish Society, especially Gmelin's Chemistry, 17 vols. 8vo.

Royal Society Catalogue of Scientific Papers. 3 vols.

The Journal of the Chemical Society from the commencement to the present time.

The Proceedings of the Royal Society from the commencement to the present time.

The Transactions of the Royal Society from the beginning of the century to the present time.

The Philosophical Magazine from the commencement to the present time.

The Proceedings of the Royal Institution. 5 vols.

Die Jahresbericht der Chemie from 1847 *to the present time*. 20 vols. and index, 2 vols.

SUBJECT XI.—ORGANIC CHEMISTRY.

First Stage or Elementary Course.

Pupils presenting themselves for examination will be expected to possess a knowledge of the following subjects :—

Definition of organic bodies; their ultimate analysis. Calculation of empirical formulæ. Compound organic radicals. Notation of organic compounds. Graphic and symbolic formulæ.

Organic Radicals.—Positive radicals. Preparation and properties of the monad radicals of the methyl series. Monad radicals of the vinyl and phenyl series.

Dyad positive radicals of the ethylene series. Preparation and properties of ethylene.

Negative radicals. Cyanogen. Oxatyl. Oxalic acid, its preparation and properties.

Hydrides of the Organic Radicals.—Methylic hydride or marsh gas. Paraffin. Benzol. Cyanic hydride or hydrocyanic acid. Oxatylic hydride or formic acid.

The Alcohols.—Definition of an alcohol. Methylic alcohol. Ethylic or common alcohol. Phenylic alcohol or carbolic acid.

The Ethers.—Definition. Preparation and properties of ethylic ether.

The Haloid Ethers.—Their constitution. Preparation and properties of ethylic chloride and iodide.

The Aldehydes.—Their nature and properties. Acetic aldehyde. Benzoic aldehyde or oil of bitter almonds.

The Acids.—Definition of an organic acid. Acetic acid. Lactic acid, Benzoic acid.

Ethereal Salts.—Definition and constitution of the ethereal salts of the monobasic acids. Preparation and properties of acetic ether and butyric ether.

Second Stage or Advanced Course.

In addition to the above subjects, students presenting themselves for this examination will be assumed to be acquainted with the following:—

. Determination of the rational formulæ of organic acids and bases. Graphic and symbolic types of organic compounds. Reduction and development of the formulæ of organic bodies. Classification of organic compounds.

Organic Radicals.—Dyad positive radicals of the acetylene series. Single and double cyanides. Manufacture of prussian blue and of oxalic acid.

Hydrides of the Organic Radicals.—Ethylic and amylic hydrides. Hydrides of the radicals of the phenyl series. Manufacture of coal-gas.

The Alcohols.—Classification, preparation and properties of alcohols. 1. Monacid alcohols; methyl series, vinyl series, allyl series, pheny series. 2. Diacid alcohols or glycols; ethylic glycol and its derivatives. 3. Triacid alcohols; glycerin, its preparation and properties.

The Ethers.—1. Ethers of the monacid alcohols;—methylic ether, allylic ether, phenylic ether. 2. Ethers of the diacid alcohols;—ethylenic oxide. 3. Ethers of the triacid alcohols;—glycylic ether.

The Haloid Ethers.—Haloid ethers of the monad, dyad, and triad positive radicals. Methylic chloride. Manufacture of chloroform. Ethylenic bromide.

The Aldehydes.—Formation and re-actions of the aldehydes of the methyl, vinyl, and phenyl series of alcohols.

The Acids.—Law of basicity of organic acids.

Monobasic acids:—Acetic or fatty series. Acrylic or oleic series. Lactic series. Pyruvic series. Glyoxylic series. Benzoic or aromatic series.

Dibasic acids:—Succinic series. Fumaric or acryloid series. Malic or lactoid series. Tartaric or glyoxyloid series.

The Anhydrides.—Definition and constitution of the anhydrides. Formation and re-actions of the anhydrides of monohydric monobasic acids, dihydric monobasic acids, and of dihydric dibasic acids.

The Ketones.—Derivation and constitution of the ketones. Preparation and properties of acetone.

Ethereal Salts.—Ethereal salts of dibasic and tribasic acids, and of monacid, diacid, and triacid alcohols.

Organic Compounds containing Nitrogen, Phosphorus, Arsenic and Antimony.—The more important natural and artificial alkaloids. Extraction of quinine from cinchona bark.

Organometallic Bodies.—Definition. Their behaviour and formation. Preparation and properties of zincic ethide, mercuric ethide and stannic ethide.

EXAMINATION FOR HONOURS.

In addition to the above, the candidate should be well acquainted with the following subjects :—

Determination of the specific gravity of gases and vapours. The methods employed in the analysis of gaseous organic bodies. Synthesis of organic compounds. Determination of the constitutional formulæ of organic bodies. Isomerism, metamerism and polymerism in organic bodies.

Organic Radicals.—Normal, secondary, and tertiary monad radicals. Isomerism of ethylene and ethylidene compounds. Relations between methyl, oxatyl and cyanogen.

Hydrides of the Organic Radicals.—Relations of the positive monad radicals to their hydrides.

The Alcohols.—Relations of the normal monacid alcohols to the monad C_nH_{2n+1} radicals, the dyad C_nH_{2n} radicals, and to the hydrides of the $C_n H_{2n+1}$ radicals.

Secondary monacid alcohols. Isopropylic, pseudamylic and pseudohexylic alcohols.

Tertiary monacid alcohols. Pseudobutylic alcohol.

Normal and secondary alcohols of the phenyl series.

Relations of glycerin to isopropylic and allylic alcohol; also to glyceric, tartronic, and acrylic acid.

Other polyacid alcohols :—Erythrite, mannite, glucose.

The Acids.—Difference between hydricity and basicity of acids.

Normal, secondary, and tertiary fatty acids. Relations of the fatty acids to the C_nH_{2n+1} series of radicals, and to the $C_nH_{2n+1}Ho$ series of alcohols. Relations of the fatty acids to each other; ascent of the series.

Normal, secondary, and olefine acids of the acrylic or oleic series. Relations of the acrylic to the acetic series of acids.

Definition and classification of the acids belonging to the lactic series Relations of the lactic to the fatty and acrylic series of acids. Isomerism in the lactic series.

Relations of the pyruvic series of acids to the oxalic and lactic series.

Relations of the glyoxylic series of acids to the glycerin series of alcohols.

Constitution and classification of the dibasic acids. Relations of the succinic series of acids to the lactic and acetic series, and to the glycols.

Isomerism in the fumaric series of dibasic acids.

Tartaric or glyoxyloid series of dibasic acids. Varieties of tartaric acid.

Constitution and classification of the tribasic acids.

The Ketones.—Isomerism in the ketone family.

Organic Compounds containing Nitrogen, Phosphorus, Arsenic, and Antimony.—The amines, phosphines, arsines, and stibines. Primary, secondary, and tertiary organic bases. Monamines, diamines, triamines, and tetramines.

Organometallic Bodies.—Their constitution and its bearing upon the doctrines of atomicity.

TEXT BOOKS.

In addition to such of the works as treat on Organic Chemistry recommended in the Syllabus of Subject X., the student's attention is drawn to the following :—

Elements of Organic Chemistry, by W. A. Miller, 8vo., 24*s*. (London, Longman, 3rd ed., 1866.)

Lecture Notes for Chemical Students (Vol. II. Organic Chemistry), by E. Frankland, 8vo. (London, Van Voorst, 2nd. ed., nearly ready.)

SUBJECT XII.—GEOLOGY.

FIRST STAGE OR ELEMENTARY COURSE.

A.—Preliminary Subjects.

a. Basis of Geology.—Definition of the objects of geology. Waste of land now going on by mechanical causes,—rain, running water, frost, snow, glaciers, and by the sea. Origin of rounded pebbles, grains of sand, and mud. Sediments carried in mechanical suspension in rivers. Deposition of strata now forming in the sea and in lakes from sediments formed mechanically. Other strata formed in part or entirely of organic remains, and how they are preserved. Proof that stratified rocks generally were formed by deposition from water, as above, and that strata have been successively deposited and are of ages less or more apart. Definition of the term igneous as applied to rocks.

b. Common Geological terms.—Definition of "crust of the earth," clay, sand, gravel, shale, sandstone, conglomerate, breccia, limestone, lava, volcanic ashes, stratum or bed, *a formation*, group of formations. Recent, Cainozoic (tertiary), Mesozoic (secondary), and Palæozoic formations. Horizontal, inclined, vertical strata. Anticlinal and synclinal curves. Contorted strata, dip, strike, outcrop, a basin. Conformable and unconformable stratification, joint, slaty cleavage, fault, lode, vein. Names of some of the metamorphic rocks.

c. Composition of principal rocks and their common minerals.—Minerals that form granites and granitic rocks; Syenites, Diorites (greenstones), Basalts, Dolerite, gneissic rocks, limestones. Coal, what originally formed from. Colouring matter of rocks.

d. Disintegration and Solutions.—Disintegration, and solutions of minerals composing rocks by means of acids; mineral springs, and substances in chemical solution in rivers, lakes, and the sea. How produced.

e. Snow and Ice.—How glaciers are formed from snow. Movement of glaciers and transport of matter on their surfaces. Moraines. Erosion of rocks, over which glaciers flow. Icebergs, whence derived. Transport of matter from cold to warmer latitudes by icebergs.

f. Rivers.—Cutting out of terraces *and valleys* by rivers. Transport of material seaward, and gradual growth of Deltas.

g. Marine Denudation, Transport and Consolidation of Material and Fossilization.—Waste of sea coasts by breakers and by help of landslips. Rounding of pebbles and grains of sand on shores and in streams. The effect of long continued marine denudation on the land; formation of bays and head-lands, &c. Distribution of sediments derived from land over sea bottoms, forming modern marine strata. Consolidation of strata by pressure, chemical changes and heat. Preservation of shells, &c., in

seas, lakes, and delta deposits, in alluvium, and in and under peat, blown sand, and volcanic ashes.

h. Central Heat, Volcanos, Earthquakes, and other Movements of the Earth's Crust.—The connexion of the corals reefs of the Pacific Ocean with the gradual sinking of the sea bottom. Fringing reefs, barrier reefs, atolls. Volcanos and their connexion with some areas of upheaval of land above the sea. Raised beaches and sea bottoms. The structure of volcanos. The wave-like motion of earthquakes. General structure of mountain chains. The existence of so-called central heat in the earth. Change of common strata, such as shale and slate, sandstone, limestone, &c., into mica-schist, gneiss, quartz rock, crystalline limestone, &c. (metamorphism).

B.—Classification of Animal and Vegetable Life.

i. A rudimentary acquaintance with the meaning of the names of thos CLASSES of animals and plants that are or may be found fossil, such as Mammalia, Aves (birds), Reptilia, Pisces (fish), Insecta, Myriapoda (centipeds, &c.), Arachnida (spiders, &c.), Crustacea (crabs, &c.), Annelida (worms, &c.), Echinodermata (sea-urchins, starfish, &c.), Cephalopoda (cuttle-fishes, &c.), Pteropoda, Pulmonata (land snails, &c.), Gasteropoda (periwinkles, limpets, &c.), Conchifera (oysters, cockles, &c.), Brachiopoda (terebratula, &c.), corals, sponges. The Vegetable Kingdom: the names of the classes and orders of plants.

Succession of Strata, Igneous Rocks, &c.

C.—Palæozoic Series.

k. Oldest known stata or the Laurentian rocks. Their metamorphic character. Oldest known fossil. Huronian rocks of Canada.

l. Cambrian and Silurian strata.—Cambrian rocks, and their traces of fossils. Lingula flags and Tremadoc slates. Llandeilo and Bala beds, and the lavas and volcanic ashes associated with them. Llandovery or Pentamerus beds. Upper Silurian series. Leading kinds of fossils common in these formations, such as the genera of Graptolites, Corals, Brachiopoda, Conchifera, Cephalopoda (chambered shells), Echinodermata, Crustacea (especially the Trilobites), and first appearance of fish remains and land plants.

m. Old Red Sandstone and Devonian strata.—The areas in Britain that formed land before the deposition of the Old Red Sandstone. Unconformities of Old Red Sandstone on older rocks. Division into lower and upper Old Red Sandstone and unconformity. The nature of the rocks. The fish found in the lower, and the fish, fresh-water shells and plants in the upper Old Red Sandstone. *Devonian strata.*—Commonly divided into lower, middle, and upper. Their marine fauna, corals, shells bivalve and univalve, Goniatites and other cephalopoda, Trilobites, &c. Difference between the Silurian and Devonian genera and species.

n. Carboniferous strata.—The ordinary succession of these strata in Wales and the South of England (See also parts of 16 in Advanced Stage). The kinds of corals, shells, and fish found in the Carboniferous Limestone, and other beds. The kind of sections found in the *Coal-measures.* The Underclay generally below beds of coal. How coal was formed from fossilized plants. How there came to be many beds of coal in one coal-field with beds of shale, ironstone, and sandstone between.

o. Permian formations.—Their succession in England and Germany, and the proofs of their unconformity on the Carboniferous strata. The

structure of the Rothliegende or Brecciated Conglomerates, the Marl-slate or Kupferschiefer, the Magnesian limestone (Zechstein). Their fossils.

D.—Mesozoic or Secondary Series.

Lower Mesozoic.

p. New Red Sandstone or Trias.—British divisions: 1st. New Red Sandstone (Bunter); 2nd. New Red Marle (Keuper). Continental divisions. New Red Sandstone, Muschelkalk, New Red Marle. Unconformity on Permian and older rocks. Great changes of life in passing from Palæozoic to Mesozoic times. Change in the relative numbers of Brachiopoda and Conchifera when compared with Palæozoic rocks, and continuation of this down to present day. New Cephalopoda, encrinites, fish, and reptiles. First known mammal. Plants of the Keuper sandstone, crustacea, reptiles, &c. Origin of rock-salt by evaporation. Gypsum of red marle. Parts of what is now the British Islands that formed land before the deposition of the Trias.

q. Rhætic or Penarth beds.—(See 19, p. 92.)

r. Lias formations and Oolites.—(Jurassic of the continent). Division into Lower, Middle, and Upper Lias, and Lower, Middle, and Upper Oolites. The names of the formations included in each of these. Characters of the rocks. Great development of life of these periods. Leading marine fossils of the Lias and land plants and insects. Common genera of Brachiopoda and Conchifera, Gasteropoda, Cephalopoda, Echinodermata, Fish, and Reptiles. Leading fossils of the Oolites as above, and also Mammalia. Proofs of land in the neighbourhood of the British Liassic, and Oolitic seas.

s. Purbeck and Wealden strata.—Their estuarine character, and proofs of this from the fossils. Generic names of leading fossils. Proofs of the existence of a neighbouring large continent.

Upper Mesozoic.

t. Cretaceous series.—British divisions, Lower and Upper and their subdivisions. The nature of the strata and general grouping of fossils (as in *r* above). Differences when compared with Oolitic genera and species. Uppermost Cretaceous beds absent in Britain, viz. the Maestricht and Faxoe beds and the beds of Aix-la-Chapelle. Account of these.

E.—Cainozoic or Tertiary Series.

u. Eocene or Lower Tertiary.—Meaning of the terms Eocene, Miocene, and Pliocene. Areas occupied by the English and French Eocene strata, and divisions of the English Eocene strata. Their fossils, freshwater, estuarine, and marine. Proofs of neighbouring land in freshwater shells, plants, and terrestrial mammalia.

v. Miocene or Middle Tertiary, of Bovey-Tracey, Mull, &c. French marine strata and freshwater and volcanic formations. The kinds of fossils they contain. The Swiss, Italian, and other continental beds. The floras of the period, insects, mammalia, reptiles, shells, &c. The Arctic Miocene beds, and flora. Indian Miocene strata and their fossils.

w. Post-Pliocene strata, Crag, &c.—Divisions of the British Crag, characters, and fossils, marine and terrestrial. Economic products. Crag of Belgium. Proportions of recent species in the different members of the Crag. Sub-Appenine strata and those of Sicily.

x. Glacial period and other strata later than the Crag.—The Forest beds beneath the boulder clay, and the union of Britain with the conti-

nent, and its Flora, terrestrial Fauna, and shells. (See also 26, p. 94.) The glaciers of the glacial period, before, during, and after the deposition of the marine boulder clays. The origin and nature of the boulder clay. Other proofs of a cold climate, and the marine and terrestrial Fauna of the period.

SECOND STAGE OR ADVANCED COURSE.

A.—Preliminary Subjects or Principles.

1. All contained in *a* of the elementary stage.

2. All contained in *b*.

3. All contained in *c*, and the chemical constituents of silica, various felspars, micas, augite, diallage, hornblende, garnet, obsidian, pitchstone, pumice. Limestone, Magnesian limestones or Dolomite. Coals, such as common house and furnace coals, cannel coals, and anthracites. Iron ores. The colouring matter of rocks. The general relative proportions in the known crust of the earth of mineral substances, such as silica, alumina, lime, magnesia, iron, &c. &c.

4. *Chemical disintegration.*—Chemical disintegration of rocks on a large scale; formation of kaolin, fireclays and other clays and shales. Origin of mineral springs, and substances in solution in rivers, seas, and other waters. Skeletons of shell fish and other marine and fresh water animals, whence derived, and how strata are formed of these.

5. *Effects of snow and ice.* — What is a glacier, and how formed. Change of snow into solid ice. Stratification and veined structure of ice. Inclinations of beds and surfaces of glaciers. Why glaciers flow. Rates of progress. Crevasses. Moraines, lateral, medial, terminal, and how they are formed. Erosion of rocks under glaciers and its results. Flow of water from lower ends of glaciers. Destruction of terminal moraines, and circumstances that induce their occasional preservation. Oscillation of size of glaciers. Deepening of valleys. Signs left by glaciers that have disappeared. Icebergs of Arctic and Antarctic regions and of South America; how formed. Ocean currents. Transport of matter by icebergs, and its distribution over existing sea bottoms. Transport of detritus by coast ice and river ice.

6. *Landslips.*—Landslips in mountainous and hilly regions, and landslips on sea coasts. Their effect in bringing matter within the influence of running water and of the sea.

7. *Rivers.* — Erosive and transporting power of brooks and rivers. Their influence in forming gorges and valleys. Origin of waterfalls. Amount of matter carried seaward by great rivers such as the Nile, the Ganges, the Mississippi, &c. The mode of formation and gradual growth of deltas and their possible age. Filling up of lakes by sediments. General effects on the form of the ground and lowering of level of continental and smaller areas by combined effects of chemical disintegration, rain, rivers, frost, snow, and glacier ice.

8. *Marine denudation.*—Waste of sea coasts by breakers and landslips. Formation of pebbles and sand on sea coasts. Amount and nature of waste of boulder clays of eastern coasts of England, &c.; of Tertiary strata, and of Cretaceous and Oolitic strata on east and south coasts. Waste of harder rocks of west of England, Wales, and Scotland. Power of breakers in moving sand and shingle, and large blocks of stone. Effect of prevalent winds on waste and transport of material along shores. Silting up of estuaries. Effect of groins and other artificial obstructions on coasts. Warping of alluvial tidal flats. Forms of sea cliffs and origin of many bays and headlands. Origin

of great plains of marine denudation by combined action of breakers, landslips, and general lowering by waste of the interior of countries. Subsequent upheaval of such plains and renewed scooping out of valleys. Origin of certain tablelands and their valleys.

9. *Distribution of Material in Sea, &c. forming Modern Strata.*—Transport of matter by great marine currents, passing mouths of rivers and along coasts. Transporting powers of tidal currents. Sifting action of the sea in arranging sediments along its bottom. Icebergs (see 5). Modern formation by above causes of beds of clay, sand, gravel, and boulder beds, and mixtures of these. Volcanic ashes falling in sea and lakes. General formation of lacustrine strata. Formation of beds of limestone by organic bodies in seas, lakes, and lagoons. Coral reefs (see 10). Salts carried in solution in rivers into lakes, evaporation of surplus water, concentration and precipitation. Origin of rock salt, &c.

10. *Fossilization and Consolidation of Strata.*—Shells and other marine organic remains buried in sediments. Also terrestrial plants. Worm burrows. Terrestrial animals. Organic remains in lakes and river deltas, in alluvial beds and brickearths; in and under peat, under blown sand, and in volcanic ashes and under lavas. Formation of sediments by foraminiferæ, &c. in deep seas. Consolidation of strata by pressure, infiltrations, and precipitations, chemical decomposition and recomposition and heat.

11. *Central Heat, Volcanos, Earthquakes, and other Movements of the Earth's Crust.*—Theory of Coral Reefs. Fringing reefs, Barrier reefs, Atolls, and proofs of gradual subsidence of the sea bottom. Connexion of coral reefs with the volcanic islands of the Pacific Ocean and areas of partial upheaval. Upheaval of the west coast of South America. Oscillations of level on the coast of the Baltic, Greenland, &c. Raised beaches and sea bottoms.

Theories of central heat how inferred. Radiation of heat from the earth, consolidation and theory of the formation and shrinkage of its crust. External phenomena of volcanos, and theories of volcanic action. Earthquakes. Mallet's theory, and oscillations of level accompanying earthquakes.

Metamorphism of rocks. Theory of slaty cleavage, passage of shales clayslate, sandstone, limestone, and their intermediate gradations into mica-schist, chlorite-schist, various kinds of gneissic rocks, quartz-rock, crystalline limestones, &c. Special development of distinct minerals in rocky masses. Relation of the above to gradual subsidence of rock masses and accumulation of strata above them. Origin of mountain chains. Disturbance and contortion of strata in successive stages, and probable causes of these phenomena.

B.—Classification of Animal and Vegetable Life.

12. All contained in *i* of the Elementary stage, p. 90, together with a general knowledge of the orders of Mammalia, Birds, Reptiles, Amphibia, Fish, Insects, &c., Crustacea, Echinodermata, Cephalopoda, Pteropoda, Pulmonata, Gasteropoda, Conchifera, Brachiopoda, Polyzoa, Corals, &c., and the classes and orders of the vegetable kingdom.

Succession of Strata, Igneous Rocks, &c.

C.—Palæozoic Series.

13. *Laurentian rocks* of Scotland, and Lower and Upper Laurentian rocks of Canada, &c. Huronian rocks of Canada. Their metamorphic character and peculiarities of structure. Eozoon Canadense, its nature,

structure, and mode of growth. Ages of their metamorphism, and the inferences to be drawn from this.

14. *Cambrian and Silurian strata*. *Cambrian rocks* and their passage into the Lingula flag series. Fossils of the Cambrian rocks; their slaty cleavage and slate quarries.

Lower Silurian.—Lingula flags, their lithological character and fossils. *Tremadoc slates,* their lithological character and fossils. Unconformity of the Llandeilo and Bala beds on these, and break in the succession of life. *Llandeilo and Bala beds,* their lithological character and fossils. The igneous rocks, lavas, ashes, &c. associated with these.

Upper Silurian.—Llandovery or *Pentamerus beds,* their fossils and unconformity on the Lower Silurian strata, and partial change of species. Remainder of the *Upper Silurian strata* of the Wenlock and Ludlow series, their characters and fossils. First appearance of fish. Remains of plants. Reasonings on the connexion of unconformable stratification with partial or total breaks in the succession of species and genera in time. (This may be applied to all the cases of unconformity subsequently noticed.)

15. *Old Red Sandstone and Devonian strata.*—Passage of Upper Silurian into Lower Old Red Sandstone in Wales and on its borders. Disappearance of the life of the Silurian period. The land that existed in Scandinavia and Britain before the deposition of the Old Red Sandstone, and round and on which the Old Red beds were deposited. Fish of the lower Old Red Sandstone; their distinctive characters.

Upper Old Red Sandstone.—Lithological characters, fish, shells, and plants. Unconformity of the upper on the lower Old Red Sandstone, and approximate or actual passage of the former into the Lower Carboniferous strata. Condition of the waters in which the Old Red Sandstone formations were probably deposited. If partly glacial, and the signs of this?

Devonian strata.—The division of these strata commonly made into Lower, Middle, and Upper Devonian. The marked difference of conditions of deposit shown in the general nature of their fossils, viz., the fish of the Old Red Sandstone, and the Corals, marine bivalve and univalve shells, Cephalopoda and Trilobites of the Devonian strata. The stratigraphical relation of the Devonian strata to the Silurian rocks of Devon and Cornwall, of Germany, and North America. The relation of the so-called Upper Devonian beds to the Carboniferous strata. The appearance of new genera and species in the Devonian rocks. The plants of the North American beds.

16. *Carboniferous strata.*—Succession of Carboniferous strata in Wales, and its borders, and the south of England, viz., Lower limestone shale, Carboniferous limestone, Upper limestone shale, Millstone grit, and Coal-measures. The lithological characters of these and their fossils, marine, freshwater, and terrestrial. The manner in which the beds below the Coal-measures were accumulated. The manner of the formation of the Coal-measures, the peculiar strata beneath each (or most) beds of coal, the nature of the plants that formed the coal, their mode of growth, and the cause of the succession of beds of coal in thick series of strata. The gradual passage of the Carboniferous strata into a set of beds differently arranged in their stratification, especially in their lower members, proceeding northwards through Lancashire and Yorkshire into Northumberland, and Scotland. The physical causes that produced this difference. Also the absence of certain members of the series in some of the English, and in part of the Scotch coal fields, and the physical phenomena that caused this absence. The Carboniferous series as developed in Ireland. The Carboniferous rocks of the continents of Europe and North America. Their resem-

blances to those of the British islands; climate, its average uniformity in space and time during this epoch. The surface areas occupied by the European Carboniferous strata now. The areas where they may be concealed under newer formations. The areas where originally formed, viz., which they spread over before reduced to their present limits by denudation. The disturbances of the Carboniferous rocks, and the reasons why coal fields (like parts of many other formations) so often lie in basins. Various kinds of coal, such as the varieties of coal commonly called bituminous, cannel coal, and anthracite. The chemical changes that vegetation underwent in its passage into coal, first on the surface, and afterwards under pressure. The passage of "bituminous" into anthracite coal and the probable reason, and the connexion of this subject with highly disturbed areas. Specialities. Development of crustacea of the Carboniferous rocks as distinguished from those of the Devonian and Silurian periods. Prevalence of certain genera of brachiopoda and conchifera, and relative proportions of these in the Carboniferous rocks when compared with older formations. Fish and reptiles of the Carboniferous rocks. Footprints, rain drops, land shells, and insects, and what they indicate. Ironstones. Mineral veins in Carboniferous limestone series.

17. *Permian formations.*—Succession of these in Britain, Germany, and Russia. 1st. The Rothliegende, its structure, and the evidences of the glacial agencies by which parts of it were deposited. *2nd.* The Kuperschiefer of Germany and Marle-slate of England, with mineral contents, fish, &c. 3rd. The Magnesian limestone (Zechstein), its mineral character and composition; its fossils; evidence of their palæozoic character, partial community of species, and numbers and size when compared with the genera and species of the Carboniferous limestone. Cause of this. Unconformity on the Carboniferous and older rocks; submersion of old lands during its deposition; bearing of this on conglomeratic and brecciated structure of the Rothliegende and the general development of the life of the period, including plants and reptiles.

D.—Mesozoic or Secondary Series.

Lower Mesozoic.

18. *Divisions of Trias, or New Red Sandstone series* (see *p*, p. 91).—Unconformity and great break in succession of life in passing from Permian to New Red Sandstone. Great development of conchifera and decrease of genera of brachiopoda. The relation of this to lapse of time, as shown by unconformity, and continued prevalence in later times of many of these early Mesozoic types. The generally unfossiliferous character of the New Red Sandstone beds (Bunter), and their minor divisions in England. The absence in England of the Muschelkalk, and its presence on the Continent. Its fossils (see *p*, p. 87). The minor divisions of the New Red Marle (Keuper). Its fossil plants and reptile bones and footprints. Microlestes. Rain drops. The rock salt of this formation, and how it was deposited. Theory of inland salt lakes or seas of the present day, and the bearing of this and of the above-named marks of rain drops and footprints on the point. New Red Sandstone of the United States, and numerous footprints of reptiles and impressions of bird-like feet. Gypsum. Those parts of the British islands that formed land before and during the New Red Sandstone period.

19. *Rhætic or Penarth Beds.*—Intermediate between New Red Marle and Lower Lias. Gradual passage of nearly unfossiliferous red marles into these more fossiliferous strata. Character and names of some of

the common fossils, such as *Avicula contorta, Cardium Rhæticum*, &c. Their affinities with Liassic forms and conformable passage into that formation in Britain.

20. *Lias formations and Oolites.* (Jurassic of the Continent).—Names of the several formations of the Lias and Oolites between the Lower Lias and the Portland Oolite in serial order, and their grouping into Lower, Middle, and Upper Lias and Oolite. Lithological characters of the Liassic formations. Fossils of the different formations. Plants and insects. Corals, brachiopoda, conchifera, gasteropoda, cephalopoda, echinodermata, crustacea, fish, and reptiles. The distinctive characters of some of these, their relative numbers compared with the same classes in the Palæozoic rocks. Nature of the connexion of the Lias with the Inferior Oolite. Lithological characters of the Oolitic formations and their uses. Marine fossils of the different formations of the above-named classes; also mammalia. Evidences of the existence of older land in the neighbourhood of the Liassic and Oolitic seas, and of the climate of the period drawn from plants and animals. Names of the most characteristic genera of Lias and Oolites, especially with reference to their prevalence, such as the names of the prevalent genera of brachiopoda, conchifera, gasteropoda, and cephalopoda, echinodermata, crustacea, fish, and reptiles. Jurassic strata of the Continents of Europe and Asia. The Jura and the Alps, and the fossils of Solenhofen. Disturbance and metamorphism of Jurassic strata. Names of some of the species characteristic of some of the formations, and extent of the community of species. Contrast the life of these epochs with similar developments in Palæozoic epochs.

21. *Purbeck and Wealden strata.*—Their general fresh-water nature and marine interstratifications. Extent of these formations in England and on the Continent. Their characters and thickness. Fossils of the Purbeck strata. Plants, land insects, mammalia, fish, reptiles, univalve and bivalve shells, and crustacea. Fossils of the Wealden formations as above. Evidences of the upheaval of extensive continental land of the period, and the manner in which the Purbeck and Wealden beds were deposited.

Upper Mesozoic.

22. *Cretaceous series.*—Description of the British divisions and subdivisions. Their lithological characters and passage of Weald clay into Lower Cretaceous beds in the Wealden area and Isle of Wight. Fossils of the formations noticed in the same way as those of the Oolitic strata. The Chalk, by what organic bodies chiefly formed. Comparison with similar deposits forming in existing oceans. Nature of flints interstratified with chalk, and vein and tabular flints. Resemblances and differences of the genera and species of the Oolitic and Cretaceous epochs, and the bearings these have on lapse of time between the deposition of the Portland Oolite and the commencement of the Atherfield clay. Continental Cretaceous geology generally. Hippurite limestone. Upper Cretaceous rocks unknown in Britain. Maestricht beds and Chalk of Faxoe in Zeeland, Denmark. Upper Cretaceous beds and flora of Aix-la-Chapelle. Cretaceous strata of North and South America.

III.—Cainozoic or Tertiary.

23. *Eocene or Lower Tertiary.*—Meaning of the terms Eocene, Miocene, and Pliocene as used by Sir Charles Lyell. Grouping of greater divisions and subdivisions of the English and French strata as usually given in manuals. Areas occupied by the English and French Eocene

strata. Evidence of the upheaval of the Chalk and older strata of Western Europe before the Eocene period. Fossils of the Thanet sand and Woolwich and Reading beds, of the London clay, Bagshot, Bracklesham, and Barton beds, and of the Isle of Wight and Hampshire strata from the Headon to the Hempstead beds inclusive; viz., plants, foraminifera, brachiopoda, conchifera, and gasteropoda, marine, estuarine, and fresh-water; cephalopoda, echinodermata, cirripedia, crustacea, fish, reptiles, birds, and mammalia. The evidence shown by these of the manner in which the different formations or parts of formations were deposited; 1st, into three broad divisions, estuarine and fluvio-marine below; marine in the middle; and fresh water, estuarine and fluvio-marine above. Evidences of land and its nature drawn from plants and from mammalian remains. Plants of the various subdivisions, and association of plants in Hempstead series with Eocene shells of lower beds. The nummulitic beds of England, the Continent of Europe, Asia, and Africa. Evidences of climates of Eocene times as indicated by shells, reptiles, and plants, &c. Original extension and subsequent denudation of Eocene beds in Britain. Denudation of the Weald.

24. *Miocene or Middle Tertiary strata.*—British Miocene strata and igneous rocks. Fossils of and nature of the strata. French marine and fresh-water and igneous rocks. Their fossils and the mammalia of the period. Miocene beds of the Rhine, Switzerland, Bohemia, and other parts of the Continent of Europe. Their divisions, lithological characters, and fossils. The Alps and other lands before the Miocene epoch, and the manner in which the Swiss, Italian, and other Miocene rocks were deposited. Theory of a glacial episode during Miocene times. Mammalia. The Miocene insects and flora, especially of the British, Swiss, Icelandic, and Arctic regions. Brown coal of England and the Continent. Disturbances of the Alps and Jura before and after the close of the Miocene epoch. Miocene rocks of India and the United States and their fossils.

25. *Post-Pliocene Strata, Crag, &c.*—(See *w*, p. 88) and in addition proofs of Britain having been joined to the Continent before the Crag epoch.

26. *Glacial period and other Strata later than the Crag.*—Old land surface of Britain later than the Crag and Forest beds. Their plants, mammalia, and shells. The Glacial period. Great glaciers before the deposition of the boulder drift in the northern and southern hemispheres generally, and in Switzerland and other mountain ranges specially. The signs of this. Boulder beds and arctic shells. Minor glaciers during and after the deposition of the boulder beds. Their signs. Erosion of valleys by ancient glaciers. Theory of the formation of rock-bound basins by glaciers and of other lakes by boulder beds and eskers or kaims. General nature of the fauna of the period. Union of the British islands and their union with the continent before and after the glacial epoch. Theories of the causes that produce this glacial period and of glacial periods in general. Volcanic rocks of the Eifel. Loess of the Rhine and other rivers, brick-earths, river-gravels, and alluvia of various ages. Mammalian and other bones in these in Europe, Asia, and America. Bone caves and the manner of the preservation of their fossils. Relics of man and his works in caves, river deposits, shell mounds of Denmark, &c., and in Swiss and other lakes. Contours of ground before and after the glacial period. Pre-glacial and post-glacial valleys.

27. Theories that have been proposed to explain the distribution of life in individual formations and throughout the whole geological series, or the origin, increase, distribution, and disappearance of species and genera commonly so called. The relations of the life of successive

formations to each other generally. Relations of existing faunas and floras of the world to those of Miocene, Pliocence, and Post-pliocene age.

28. Water-bearing strata and underground drainage. Artesian and other wells. Rocks in which ores are found, and mode of occurrence of those in beds, lodes, and superficial detritus. The rules that ought to guide the miner in sinking for coal and other minerals, when the beds in which they lie are concealed by overlying and unconformable strata.

Examination for Honours.

In addition to the foregoing, candidates may be examined in any subjects treated of in standard manuals and other books mentioned below.

Text Books.

The following may be used as text-books:—

Principles of Geology, by Sir C. Lyell, 2 vols., 8vo., 32*s*. (London, Murray, 10th ed., 1868.)

Elements of Geology, by Sir C. Lyell, 8vo., 18*s*. (London, Murray, 6th ed., 1868.)

The Students Manual of Geology, by J. B. Jukes, 8vo., 12*s*. 6*d*. (London, Longman, 2nd ed., 1862.)

The School Manual of Geology, by J. B. Jukes, 12mo., 4*s*. (London, Longman, 1863.)

Introductory Text-book of Geology, by D. Page, 8vo., 2*s*. (Edinburgh, Blackwood, 7th ed., 1867.)

Advanced Text-book of Geology, by D. Page, 8vo., 7*s*. 6*d*. (Edinburgh, Blackwood, 4th ed., 1867.)

Physical Geography and Geology of Great Britain, by A. C. Ramsay, 8vo., 5*s*. (London, stamped, 2nd ed., 1864.)

Popular Physical Geology, by J. B. Jukes, 16mo., 5*s*. (London, Routledge, 1866.)

Text-book of Geology, by J. D. Dana, 12mo., 7*s*. 6*d*. (Philadelphia, 1864.)

Manual of Geology, by J. D. Dana, 8vo., 21*s*. (Philadelphia, 1863.)

A Handbook of Geological Terms, by D. Page, 8vo., 7*s*. 6*d*. (Edinburgh, Blackwood, 2nd ed., 1865.)

Recent and Fossil Shells, by S. P. Woodward (Weale's series), 18mo., 5*s*. 6*d*. (London, Weale, 1851.)

Glossary of Mineralogy, by H. Bristow, 8vo., 6*s*. (London, Longman, 1867.)

Other books that may be consulted:—

Siluria, by Sir R. I. Murchison, 8vo., 30*s*. (London, Murray, 4th ed., 1867.)

Geological Observer, by Sir H. De la Beche, 8vo., 18*s*. (London, Longman, 1853.)

Voyage of a Naturalist round the World, by C. Darwin, 8vo., 8*s*. 6*d*. (London, Murray, 1845.)

The Origin of Species, by C. Darwin, 8vo., 15*s*. (London, Murray, new ed., 1866.)

Catalogue of British Fossils, by J. Morris, 8vo., 10*s*. (London, Van Voorst, 1843.)

Chart of the Characteristic British Tertiary Fossils, by J. W. Lowry, mounted on linen, 10*s*. (London, Stanford.)

Chart of the Genera of Fossil Crustacea, by J. W. Salter and H. Woodward, mounted, 10*s*. 6*d*. (London, Stanford.)

SUBJECT XIII.—MINERALOGY.

First Stage or Elementary Course.

A. Instruction in this subject should commence with a distinct understanding of the characters and circumstances by which minerals, properly so called, are to be distinguished from other inorganic substances, and of the position of this science in relation to the collateral sciences of physics, chemistry, and geology. Definitions of a mineral, a crystal, and of the conditions termed crystalline and amorphous. Occurrence of other more or less regular forms not crystals. Distinction of compound masses or mixtures of minerals.

B. *Crystallography*, as the essential means of appreciating the forms naturally assumed, under favourable conditions, by almost all inorganic bodies of definite composition, must commence with the needful definitions; faces, edges, and solid angles; plane figures of three, four, five, six, and eight sides; the names and chief features of the more important geometrical solid figures which occur among crystals; the object of referring the faces to systems of axes, and the various directions in which these may be placed.

Method of drawing crystals isometrically.

Relation of the hemihedral to holohedral forms.

The grounds for grouping the various crystal forms into six systems.

Laws by which the derivation of one form from another within the limits of the same system is determined.

Complex or modified crystals may be regarded as combinations of the faces of two or more simple forms.

The leading figures of the six systems to be studied, with frequent practice in drawing.

Twin crystals and hemitropes; the relative position of the axes of their several portions.

Irregularities to which the surface of crystal faces is subject, certain angular elements remaining constant; measurement of these latter by instruments. Principles of the contact goniometer and of Wollaston's goniometer.

C. *Aggregation*, or natural grouping of—1stly, the distinctly crystallized minerals; 2ndly, of the crystalline minerals, especially with reference to structure and general form of masses of the useful minerals and of crystalline rocks.

D. *Other physical properties.*—The cleavage of crystallised substances, and its relation to crystalline form. Fracture, its various characters. Comparative hardness, how best determined. Different qualities of tenacity. Specific gravity of solids, how determined; the balance, the aræometer.

Property of magnetism; what substances are capable of being attracted by a magnet, and what is the comparative intensity of the effect. Polarity. Influence of certain minerals disseminated in rocks on the correctness of surveys.

Peculiarities of smell and of taste which distinguish a limited number of minerals.

E. *Optical characters.*—Single and double refraction, and their relation to certain crystallographical systems.

Different degrees of lustre and transparency.

Colour essential in some species, not so in others; varieties of colour, how far they are capable of definition.

Phosphorescence as produced by different methods and exhibited by certain minerals.

F. *Chemical characters.*—Simple or elementary substances; some of them occur as minerals; their symbols and the derivation of the same. Equivalents; chemical combinations; principal groups of these occurring in the mineral kingdom.

Dimorphism of particular substances, accompanied by a difference in other physical characters besides form.

The employment of acids in the discrimination of minerals.

The blowpipe, its form and uses; the reducing and the oxidizing flames. Trial of comparative fusibility, of the colour given to the flame, the incrustation on charcoal; the effects of fusing various metallic oxides with beads of borax glass.

Pseudomorphism.—The phenomena presented by minerals which have the composition of one mineral coupled with the form of another. Analogous action of fossilization or petrifaction.

G. General requirements of a system of classification of minerals.

H. The physiography or systematic description of minerals. This last division should include all the more remarkable varieties as well as species, and should take especial note of the modes and places of occurrence, as well as of the association of particular groups of minerals in certain veins or formations. Vague statements, such as giving the the locality of a mineral "Germany" or "North America," should be eschewed.

It would not be expected that the elementary course should include the description of the rarer substances, or of those species whose characters are not yet well ascertained, but attention should chiefly be given to those species which form the constituents of rocks and those which as ores supply the materials for the production of the useful metals.

Second Stage or Advanced Course.

A. Discussion of the relation of true minerals to other inorganic substances, and how far bodies of organic origin may be classed among minerals.

B. The dependence of symmetry in crystal forms on the axial system. The crystallographical value of a face is the same as that of any plane parallel to it, on the same side of the centre of the crystal. Position of the normals to a face. The methods of indicating the faces, and thence the entire forms of crystals by symbols. Drawing of a sphere of projection in which the poles of the crystal faces may be shown. Convenience of representing in a great circle the poles of a zone of faces. The magnitude of the angle between the normals being the supplement of the mutual inclination of the planes, the first kind of measurement (*i.e.* between the normals) is adopted by certain authors, and is easily reducible into the other kind. Statement of the angular and linear dimensions requiring to be determined for the description of the simple forms of all the systems after the cubical.

Twin crystals, the twin plane, and twin axes; examples of their position in important minerals of the several systems.

C. Reticulated, wiry, and capillary forms, explanations suggested for their formation. Other peculiarities in grouping.

D. The prevailing directions of cleavage in the several crystallographical systems.

Determination of the specific gravity of a substance contained in a mechanical mixture.

Electricity; by what means this property is exhibited in different minerals.

E. Refraction of light; different positions of the ordinary and extraordinary ray in doubly-refracting bodies. Optic axes of a crystal, their variation in different species of minerals.

Polarized light, its connexion with double refraction. Construction of the polariscope.

Dichroism and pleochroism, a remarkable property of some few minerals.

F. Character of the chemical composition of the more complex minerals.

The electro-negative element in chemical combinations has the preponderating effect in influencing the external character.

Isomorphism, as shown by Mitscherlich, to result from a group of—1st, isomorphous acids; 2nd, of isomorphous bases. Polymeric isomorphism of Scheerer; its meaning, and the arguments in its favour. Vicarious or irregular replacement among one another of isomorphous constituents.

Testing of minerals in the moist way simply practicable for qualitative purposes.

Treatment of various metallic ores before the blow-pipes.

Pseudomorphous substances as arranged in groups according to the nature and degree of change they have undergone.

Discussion of anogenic and katogenic pseudomorphs, or those which have been produced above by oxidizing, and below by reducing processes respectively.

Extension of pseudomorphous action on a large scale to "gossans" and to geological formations.

G. Methods of classification as proposed by the leading authors in mineralogy. Review of the difficulties caused in classification by the occurrence of the isomorphous substances.

Discussion of the means of defining a species among minerals.

H. Species and varieties of minerals as described in the best manuals. Their occurrence under various circumstances to be particularly studied. The changes in composition wrought by nature (pseudomorphous action), by which one species is converted into another, and the essential points of difference between species much alike in certain characters, will be held of much importance in dealing with the minerals of special value or interest. It is not expected that the memory should be charged with the details of substances of very rare occurrence, or of doubtful independence as species.

Examination for Honours.

The questions will as a general rule be such as are embraced in the above syllabus, but candidates will be required to prove a practical acquaintance with minerals and with crystal forms, and will need to have studied some of the more advanced works mentioned below.

Text Books.

As text-books may be recommended—

Elementary Course of Mineralogy and Geology, by D. T. Ansted, 8vo., 12*s*. (London, Van Voorst, 1856.)

Elements of Mineralogy, by Jas. Nicol, 12mo., 5*s*.
(London, Longman, new ed., 1858.)
Manual of Mineralogy, by J. D. Dana, 8vo., 7*s*. 6*d*.
(New York, new ed., 1860.)
Glossary of Mineralogy, by H. W. Bristow, 8vo., 6*s*.
(London, Longman, 1867.)
The Mineralogist's Directory, by Townshend Hall.
(London, Stamford, 1868.)

For more advanced students—

Elementary Introduction to Mineralogy, by Brooke and Miller. 8vo. 18*s*. (London, Simpkin, 1852.)
Crystallography, by Rev. W. Mitchell, in Orr's "*Circle of the Sciences.*" 8vo. 3*s*. (London, Griffin.)
System of Mineralogy, by J. D. Dana, 8vo., 36*s*.
(New York, 5th ed., 1868.)
Introduction to the use of the Blowpipe, by Scheerer, translated by H. Blanford. (London, Williams and Norgate, 1856.)
Elemente der Mineralogie, von C. F. Naumann, 8vo, 9*s*.
(Leipzig, Engelmann, 7th ed., 1868.)
Paragenesis der Mineralien, von. A. Breithaupt, 8vo., 5*s*. 6*d*.
(Freiberg, Engelhardt, 1849.)
Handbuch der Mineralogie, von W.Haidinger, 8vo., 10*s*.
(Vienna, Braumüller, new ed., 1865.)
Manuel de Minéralogie, par Des Cloiseaux, Tome I., 8vo., 17*s*.
(Paris, Dunod, 1862.)
Manual of the Mineralogy of Great Britain and Ireland, by Greg and Lettsom, 8vo., 15*s*. (London, Van Voorst, 1858.)

When it is intended to teach this subject with special reference to the practical working of minerals, the physiographical part will be occupied more particularly with certain of the useful species and their associated substances, and the following works may be consulted:—

The Metalliferous Deposits of Cornwall and Devon, by W. J. Henwood. 1843.
Bischof's Chemical and Physical Geology, translated by the Cavendish Society, 2 vols., 8vo., 21*s*. (London, 1854.)

SUBJECT XIV.—ANIMAL PHYSIOLOGY.

First Stage or Elementary Course.

Questions will be confined to the under-mentioned topics.

A. Anatomical Preliminaries.

The general build of the human body.

The meaning of the terms skull, vertebra, rib, sternum; scapula, clavicle, humerus, radius, ulna, carpus, metacarpus, phalanges (of the hand); pelvis, femur, tibia, fibula, tarsus, metatarsus, phalanges (of the foot); integument, mucous membrane, connective tissue, tendon, ligament, cartilage, muscle, nerve.

The position in the body and the general form and size of the following internal parts:—The brain and spinal cord; the pharynx, the gullet, stomach, and intestines; the salivary glands, the liver and pancreas; the

posterior nares, the larynx, trachea, and lungs; the kidneys and bladder; the heart and the great vessels; the thoracic duct, and the chief lymphatic glands; the spleen; the diaphragm.

B. Chemical Preliminaries.

The composition of air, water, carbonic acid, and ammonia.

The chemical elements of which protein, fat, and sugar are composed.

The nature of the most important mineral compounds which are formed in the body.

The ultimate chemical products of the decay and putrefaction of the dead body.

C. General View of the Animal Body in Action.

The evidence that the body constantly wastes during life; the nature of the waste products, and of the compensation for waste; the essential characters of food stuffs.

The part played by oxygen in the economy.

The number, position, and uses of the sensory organs.

The nature of cilia and the movements to which they give rise.

The physiological properties of muscular tissue.

The modes in which muscles give rise to movements and sustain the body in the erect posture.

The physiological properties of nervous tissue.

The general functions of the brain and of the spinal cord.

Local and general death.

D. Special Physiology.

a. The circulatory Organs.

The arrangement of the chambers of the heart and of its valves.

The general differences between arteries, veins, and capillaries.

The course of the circulation of the blood and the reasons why the blood moves only in one direction.

The meaning of the beat of the heart, of the pulse in the arteries, and of the jet-like flow of blood from a cut artery.

The evidence of the circulation obtainable in the living body.

b. The Blood.

The phenomena presented by blood drawn from the body.

The general nature of the corpuscles of the blood.

The general composition of the blood.

The difference between blood and lymph.

c. Respiration and other processes which modify the condition of the Blood.

The obvious differences between arterial blood and venous blood.

How venous blood can be converted into arterial blood out of the body.

How and where venous is converted into arterial blood in the body.

How the air which leaves the lungs differs from that which enters them.

The general nature of the respiratory movements.

The course of the air, when breathing takes place through the nose.

The conditions which give rise to asphyxia.

The essential composition of the urine.

The general structure of the apparatus by which its separation from the blood is effected.

The essential composition of the sweat.
The general structure and functions of the skin.
The manner in which the blood enters and leaves the liver.
The products yielded by the liver to the blood directly, and through the medium of the alimentary canal.
The chief characters of the bile. The use of the gall-bladder.
The source of the heat of the body. The manner in which the temperature of the body is distributed and regulated.

d. Alimentation.

The quantity of dry solid and gaseous aliments required daily by an adult man.
The classification of food stuffs.
The economy of a mixed diet.
What becomes of proteid, fatty, amyloid, and mineral food stuffs respectively.
The nature and functions of the salivary, gastric, and pancreatic secretions.
The manner in which nutritive matters are absorbed, and innutritious matters excreted, from the alimentary canal.

e. Animal Mechanics.

The different kinds of levers and their exemplifications in the body.
The nature of joints, with examples of ball and socket, hinge and pivot-joints.
The conditions of the production of the voice.
The difference between voice and speech.

f. The Senses and their Organs.

The general structure of the organ of touch.
The means of measuring the acuteness of the sense of touch in different parts of the body.
The general structure of the organs of taste and of smell.
The external auditory passage and the tympanic membrane.
The tympanum and how it opens into the pharynx.
The chain of ear bones and their connection on the one hand with the tympanic membrane, and on the other with the membrane of the fenestra ovalis.
The form of the membranous labyrinth and of the cochlea. The nature of the endolymph and perilymph and of the otoconia. The relation of the auditory nerve to the labyrinth.
The manner in which the impact of sound-waves on the tympanic membrane affects the auditory nerve.
The eyelids, and the manner in which they are moved. The lachrymal apparatus. The form of the eyeball; its general structure, and the functions of its component parts.
The manner in which the movements of the eyeball are effected.
The blind spot. The duration of luminous impressions. Colour-blindness.

g. The Nervous System.

The difference between the cerebro-spinal and the sympathetic systems.
The nature and functions of the roots of the spinal nerves.
The evidence that the spinal cord is capable of effecting reflex action

The nature and functions of vaso-motor nerves.

The most important functional peculiarities of the medulla oblongata.

The evidence that the higher faculties of the mind have their seat in the brain.

The number, names, and functions of the cerebral nerves.

Second Stage or Advanced Course.

In addition to the preceding, a knowledge of the following subjects will be required :—

a. The Circulatory System.

The minute structure of the organs of circulation. The manner in which they are supplied with blood and with nervous energy. The nature of the pericardium.

The detailed analysis of the movements and sounds of the heart, and of the phenomena of the pulse. The causes of blushing and of pallor. The influence of the respiratory movements on the circulation. The effect of irritation of the pneumogastric nerve upon the heart's action.

The structure of the lymphatic vessels and glands, and the connexion of the lymphatic, with the blood vascular, system.

b. The Blood, the Lymph, and the Chyle.

The sizes and the structure of the corpuscles of these fluids. The phenomena which they exhibit. Their probable functions. The composition of the blood in detail. The nature of the process of coagulation.

c. The Respiratory System.

The structure of the thorax. The pleuræ. The structure of the respiratory organs and the distribution of the blood through them. The analysis of the respiratory movements in detail. The mechanism by which coughing, sneezing, sighing, and hiccoughing are effected. The physical and chemical processes involved in the conversion of inspired into expired air, and of venous into arterial blood. The quantity of waste products excreted and of oxygen taken in by the lungs in twenty-four hours. The rationale of ventilation.

The Urinary System.

The minute structure of the kidney, ureter, and bladder.

The circulation in the kidney and the changes which the blood undergoes in passing through it.

The quantity of waste products of all kinds excreted by the kidneys in 24 hours.

The Skin.

The minute structure of the skin, of the hairs, nails, and glands connected with it. The muscles of the hair-sacs.

The quantity of waste products excreted by the skin in 24 hours.

The Liver.

The structure of the liver, and the course of the blood through it. The arrangement of the ducts of the liver. The composition of the bile, and the quantity of that fluid secreted daily. The functions of the bile. The nature and uses of glycogen.

The Spleen and the other Ductless Glands.

The structure and probable functions of these organs.

The Alimentary Canal.

The structure, forms, kinds, and succession of the teeth. The structure and functions of the salivary glands. The structure and functions of the tongue, the soft palate, uvula and tonsils. The pharynx and the œsophagus and the structure of their walls. The stomach, its form; the structure of its walls; its glands and their functions. The divisions of the intestine. The structure of its walls. Villi. Glands. Peyer's patches. The structure and functions of the pancreas. The peritoneum and the nature of the mesentery.

The details of the digestive and absorptive processes. The profits and losses of the economy, and how they are balanced during health.

The Muscular System and Animal Mechanics.

The minute structure of fibrous, cartilaginous, bony, and muscular tissue.

The physical, chemical, and physiological properties of muscle. Rigor mortis. The mechanism of standing, walking, running, and jumping.

The structure and working of the larynx. The mode in which consonantal and vowel sounds and articulate speech are produced.

The Senses.

The structure of the papillæ of the skin, and of the tactile corpuscles.

The muscular sense.

The minute structure and nervous supply of the tongue as a sensory organ.

The structure of the olfactory organ. The nature and extent of the air chambers connected with it. The minute structure of the Schneiderian membrane and of the olfactory nerve-fibres. The mechanism of smelling.

The structure of the ear. The external ear and the muscles which move it. The muscles connected with the ear bones and their actions.

The minute structure of the membranous labyrinth and cochlea. The probable functions of these organs.

The minute structure and the properties of the various constituents and coverings of the eyeball. Complementary colours. Phosphenes. Purkinje's figures. Adjustment. Regulation of light. Double vision with one eye.

Sensations and Judgments.

The notion of roundness. Subjective sensations. Ventriloquism. Erect vision. Double vision and single vision with two eyes. Judgments of distance and form. The pseudoscope and the stereoscope.

The Nervous System.

The structure of ganglionic corpuscles and of nerve fibres.

The structure of the investments of the brain and spinal cord.

The minute structure of the spinal cord. The general disposition of the histological elements of the brain.

The names and positions of the larger divisions of the brain and of its ventricles.

The origins and functions of the spinal and cerebral nerves in detail.

The effect of cutting the spinal cord in various ways, and of injuries to the medulla oblongata.

The effect of removing the hemispheres of the brain.

Unconscious cerebration and acquired reflex action.

Reproduction.

The structure of the ovum and of the spermatozoon.

The process of yelk division.

The formation of the blastoderm and the development therefrom of the body of the embryo, with amnion, allantois, and yelk sac.

The nature of the chorion, of the decidua, and of the placenta.

The mode in which the fœtus is nourished.

The development of the heart and the fœtal circulation. The changes in the circulation which take place at birth.

The lacteal glands and lactation.

The modifications in the proportions of the body from birth to adult age.

The general modifications in the condition of the skeleton from its earliest appearance. The notochord. The process of ossification.

The thymus and thyroid glands.

The two dentitions.

Examination for Honours.

Candidates will be examined in any subject treated of in the standard English works upon Physiology, such as Carpenter's *Principles of Human Physiology*, and Marshall's *Outlines of Human and Comparative Physiology*.

Text Books.

For the elementary stage—

Lessons in Elementary Physiology, by T. H. Huxley, 18mo., 4*s*. 6*d*. (London, Macmillan, 1868.)

is recommended as a text book.

For the advanced stage, in addition to the above, the following works are recommended :—

A Manual of Physiology, by W. B. Carpenter, 12mo., 12*s*. 6*d*. (London, Churchill, 4th ed., 1865.)

Handbook of Physiology, by W. S. Kirkes, 8vo., 12*s*. 6*d*. (London, Walton and Maberly.)

A Description of the Human Body, its Structure and Functions, by J. Marshall, 2 vols., 4to. 21*s*. (London, A. Tarrant, 2nd ed., 1870.)

SUBJECT XV.—ZOOLOGY.

N.B.—Students should have been instructed in the elements of physiology before commencing the study of Zoology. After May 1869 no candidate will be passed in Zoology unless at the same, or at a previous, examination he has been passed in the elementary stage of Animal Physiology.

First Stage or Elementary Course.

Questions will be confined to the following topics :—

The characteristic and distinctive features of the following groups of animals :—*Vertebrata, Mammalia, Aves, Reptilia, Amphibia, Pisces, Arthropoda, Insecta, Myriapoda, Arachnida, Crustacea, Annelida, Echi-*

nodermata, Rotifera, Infusoria, Spongida, Foraminifera, Cœlenterata, Hydrozoa, Actinozoa, Polyzoa, Brachiopoda, Lamellibranchiata, Pulmogasteropoda, Branchio-gasteropoda, Cephalopoda.

(Candidates will be expected to be able to refer any British member of one of these groups to its proper group.)

The general nature and arrangement of the skeleton (or hard parts) in *Foraminifera, Spongida, Hydrozoa, Actinozoa, Brachiopoda, Lamellibranchiata, Gasteropoda, Echinodermata, Arthropoda, Vertebrata.*

The general nature and working of the alimentary apparatus observed in *Infusoria, Hydrozoa, Actinozoa, Polyzoa, Gasteropoda, Annelida, Arthropoda, Pisces, Aves, Mammalia.*

The general structure and working of the organs of circulation and respiration in *Lamellibranchiata, Gasteropoda, Crustacea, Arachnida, Insecta, Pisces, Amphibia, Reptilia, Aves, Mammalia.*

The general nature of the nervous system in *Rotifera, Echinodermata, Annelida, Arthropoda, Polyzoa, Lamellibranchiata, Vertebrata.*

The principal characters of the organs of hearing in *Lamellibranchiata, Crustacea, Pisces,* and *Mammalia;* and of the organ of sight in *Annelida, Arachnida, Insecta, Gasteropoda,* and *Vertebrata.*

The general nature of the process of development in *Hydrozoa, Lamellibranchiata, Crustacea, Insecta, Amphibia,* and *Aves.*

Text Books.

A Manual of Zoology. Vol. I. Invertebrate Animals. By H. A. Nicholson. Crown 8vo. 7*s.* 6*d.* Blackwood and Sons.

Introduction to the Classification of Animals. By T. H. Huxley, LL.D., F.R.S. 8vo. 6*s.* Churchill and Sons.

Second Stage or Advanced Course.

Questions may be set in all subjects enumerated under the Elementary Stage, and in addition on the following topics :—

The characters and distinctive peculiarities of the *Nematoidea, Acanthocephala, Turbellaria, Trematoda, Ascidioida* (or *Tunicata*), *Pteropoda, Radiolaria* (or *Polycistina*), *Gregarinida, Rhizopoda;* and of the principal subdivisions (orders) of the *Mammalia, Aves, Reptilia, Amphibia, Pisces, Insecta, Arachnida, Crustacea, Annelida, Echinodermata, Hydrozoa, Actinozoa, Brachiopoda, Lamellibranchiata Gasteropoda, Cephalopoda.*

Reference of any specimen to its proper class and order.

The most important modifications of the vertebrate skeleton observable in *Pharyngobranchii, Marsipobranchii, Elasmobranchii, Teleostei, Chelonia, Ophidia, Aves, Monotremata, Marsupialia, Cetacea, Cheiroptera, Ungulata, Simiadæ, Man.*

The leading modifications of the appendages of the body and head in the *Arthropoda.*

The structure of the test in *Echinus, Uraster,* and *Comatula* (*Antedon*).

The structure and nomenclature of the parts of the shell in *Brachiopoda, Lamellibranchiata, Gasteropoda,* and *Cephalopoda.*

The structure of the corallum in the *Actinozoa.*

The structure, succession, and chief forms of the teeth in *Mammalia.* The dental formulæ of Man, of old and new world apes; of the hedgehog, the dog, the cat, the horse, the ox, the pig, the rabbit, and the rat.

The structure and mode of formation of "whalebone."

The structure and movements of the beaks of *Aves* and *Chelonia.*

The poison fangs of snakes and the mechanism by which they are moved.

The teeth of ordinary fishes, of sharks, rays, *Chimeræ*, and lampreys.

The alimentary apparatus of the *Ruminantia*, and the mode in which it works.

The leading forms assumed by the circulatory, respiratory, renal, hepatic, and salivary organs in the animal series.

The modifications of the brain and of the sensory organs in the *Vertebata, Arthropoda, Cephalopoda*, and *Gasteropoda*.

The leading forms of the reproductive apparatus, with the general process of development, in *Mammalia, Aves, Reptilia, Amphibia, Pisces, Arthropoda, Annelida, Echinodermata, Trematoda, Tæniada, Spongida, Cœlenterata, Lamellibranchiata, Pulmo-gasteropoda, Branchio-gasteropoda, Cephalopoda*.

The distribution of animals. The principal forms of animal life characteristic of Australia; of South America, with Mexico; of Africa, south of the Sahara; of Hindostan; of Central Asia, with Europe and North Africa; of America, north of Mexico; of the Atlantic, the Indo-Pacific, the Arctic and Antarctic Oceans.

The broad facts relating to the succession of animal life upon the globe.

The natural history of the animals which supply articles of commerce.

Examination for Honours.

In this examination questions will be set at the discretion of the Examiner, who will have regard to the state of Zoological teaching in the country and the means of acquiring information.

SUBJECT XVI.—VEGETABLE ANATOMY AND PHYSIOLOGY.

The examiner in botany finds that the number of candidates in vegetable physiology is always much greater than in systematic botany. He ventures to suggest to the teachers that, considering the age of most of their pupils, it would be better to begin with systematic botany, and not to teach vegetable physiology till the pupil has passed the first stage, at least, of Subject XVII. The teaching would thus be more practical, and would be confined chiefly to the plants of the district and to the common garden plants.

The teaching should be carried on in the field, if possible, or in any case by means of fresh specimens rather than drawings.

I. First Stage or Elementary Course.

Distinctions between flowering and flowerless plants. Growth of flowering plant from seed. Plumule, radicle, cotyledons.

Ascending and descending axis: axial and appendicular organs.

Cells: Parenchyma, prosenchyma, ducts, spiral vessels. Vascular bundles.

Structure and growth of root. Spongioles.

Structure of stem. Pith, wood, bark, medullary rays.

Epidermis. Hairs, prickles.

Nature, position, and development of leaf buds: branches and spines.

Venation and structure of leaves. Stomates.

Floral organs, protective and essential. Sexes of plants.

Structure and dehiscence of anthers. Structure of pollen grain. Evolution and course of pollen tube.

Stigma. Ovule: nucleus and coats, foramen. Anatropous campylotropous and orthotropous ovules. Impregnation. Embryo sac.

Seed: hilum, chalaza, rhaphe. Albumen. Embryo: monocotyledonous and dicotyledonous.

Food of plants. Course of sap, osmose, exhalation, respiration (by day and night), assimilation. Cambium layer.

Composition of cellulose, starch, sugar, gum, gluten, chlorophyll.

In the earlier course these subjects should be taught quite generally, as they occur in the ordinary type of structure. All exceptions should be reserved for the higher course.

Second Stage or Advanced Course.

Cell development by division and free cell formation. Protoplasm. Formation of ducts and vessels.

Cell contents. Cytoblast or nucleus, secondary deposits, air, crystals, rhaphides, chlorophyll, oil.

Circulation of fluids in cells.

Functions of cells and vessels. Intercellular spaces, latex canals.

Structure of trunk of climbing plants, and of tree ferns.

Parasitical plants; leafy and leafless, on root, stem, bark.

Development of leaves.

Abnormal forms of stomates.

Pollen formation.

Ovule of Loranthaceæ.

Impregnation and embryogeny of Conifers and their allies.

Reproduction of Cryptogams.

Propagation of plants otherwise than by seed.

Physiology of flower; absorption of oxygen, evolution of heat.

Irritability of leaves, tendrils, stamens.

Theory of manures.

Differences between animals and plants.

Examination for Honours.

Questions will be set at the discretion of the examiner, who will have regard to the state of botanical learning in the country and the means of acquiring information.

For text books see end of next subject.

SUBJECT XVII.—SYSTEMATIC AND ECONOMIC BOTANY.

First Stage or Elementary Course.

A.—Morphology.

Ascending and descending axis.

Root: annual, biennial, perennial; fibrous, tuberous, tap, &c.

Stem: woody or herbaceous; erect or creeping; corm, bulb, rhizome.

Leaf: entire or variously cut; simple or compound; kinds of composition. Petiole, blade.

Stipules. Tendrils. Bracts.

Inflorescence: raceme, spike, catkin, umbel, capitulum, corymb, panicle.

Flower: complete or incomplete, uni- or bi-sexual; regular or irregular.

Calyx and corolla: poly- or gamo- sepalous or petalous; persistent or deciduous; valvate, imbricated or twisted in estivation.

Stamens: number and relative position; insertion, cohesion. Filament, anther.

Ovary: adherent or free; of one or more carpels, uni- or multi-locular; number and cohesion of styles.

Ovules: solitary or numerous; erect, horizontal, or pendulous; with axile, free central or parietal placentation.

Fruit: dehiscent or indehiscent; succulent or dry; drupe, berry, achene, capsule, legume, pod.

B.—Classification.

Dicotyledones: thalalamifloræ, calycifloræ, corollifloræ, incompletæ.
Monocotyledones.
Acotyledones: acrogens, thallogens.
Distinctive characters of the largest British natural orders, viz.:—

Ranunculaceæ.	Scrophulariaceæ.
Cruciferæ.	Labiatæ.
Caryophylleæ.	Orchideæ.
Leguminosæ.	Liliaceæ.
Rosaceæ.	Cyperaceæ.
Umbelliferæ.	Gramineæ.
Compositæ.	

C.—Economic Botany.

The candidate will be expected to know the economic plants indigenous to Great Britain and Ireland, as well as those contained in the following list:—

Wheat.	Gum.	Teak.
Barley.	Caoutchouc.	Maple.
Oats.	Gutta Percha.	Walnut.
Rye.	Turpentine.	Opium.
Rice.	Palm oil.	Quinine.
Indian corn.	Cocoanut oil.	Jalap.
Pea.	Castor oil.	Ipecacuanha.
Bean.	Olive oil.	Aloes.
French bean.	Indigo.	Rhubarb.
Pasture Grasses.	Logwood.	Senna.
Clover.	Madder.	Nutmeg.
Turnip.	Catechu.	Cloves.
Mangold.	Galls.	Pepper.
Hops.	Oak bark.	Orange.
Tea.	Cotton.	Vine.
Coffee.	Flax.	Almond.
Cocoa.	Hemp.	Peach.
Chicory.	Jute.	Plum.
Tobacco.	Mahogany.	Melon.
Starch.	Oak.	Cucumber.
Sugar.	Deal.	Gourd.

The use of the product, the part of the plant affording it, the name and natural order of the plant which yields it, its native country when wild, and when cultivated the area of cultivation will be expected to be known.

Second Stage or Advanced Course.

Modifications of stem structure (as in cactus, &c.)
Modifications of leaf structure: Phyllodes, pitchers.

Morphology of cryptogams: frond, thallus, theca or spore-case, sorus, elater, mycelium, spore, &c.
Phyllotaxis.
Theory of Inflorescence.
Metamorphosis of flowers.
Dimorphism of flowers.
Principles of classification.
Natural family or order, genus, species, variety.
Variations of cultivated plants.
Characters of all British natural orders, and of the largest and most important exotic orders.
Classification of Cryptogams: characters of ferns, Lycopodiaceæ, Equisetaceæ, mosses, Hepaticæ, Characeæ, Algae, Lichens, Fungi.
Principal economic plants belonging to each natural order.
General principles of geographical botany.

Examination for Honours.

Questions at the discretion of the examiner, who will have regard to the state of botanical learning in the country and the means of acquiring information.

As text books may be cited:—

Asa Gray. *Lessons in Botany*. One dollar. (Phinney, New York.)
Balfour. *Outlines of Botany*. Fcap. 8vo. 7*s*. (A. and C. Black.)
„ *Class Book of Botany*. 31*s*. 6*d*.
„ „ „ In two parts, at 10*s*. 6*d*. and 21*s*. (A. and C. Black.)
„ *Manual of Botany*. 10*s*. 6*d*. (A. and C. Black.)
Bentley. *Manual of Botany*. 12*s*. 6*d*.
Henfrey. *Elementary Course of Botany*. 12*s*. 6*d*.
„ *Rudiments of Botany*. 3*s*. 6*d*. (Van Voorst.)
Lindley. *School Botany*. 5*s*. 6*d*. (Bradbury and Evans.)
„ *Systematic and Descriptive Botany*. 3*s*. (Society for Diffusion of Useful Knowledge.)
„ *Vegetable Kingdom*. 36*s*. (Bradbury and Evans.)
Botany, Structural, Physiological. 3*s*. (Society for Diffusion of Useful Knowledge.)
Treasury of Botany, in two parts. 10*s*. (Longmans.)
Oliver. *Lessons in Elementary Botany*. 4*s*. 6*d*. (Macmillan.)

SUBJECT XVIII.—PRINCIPLES OF MINING.

The Art of Mining embraces so wide a field of study that equal practical proficiency in its various branches is not to be expected from persons engaged in different classes of mines, nor equal knowledge of its general features from students brought up in districts where only one or another branch of the subject is practised. The examination papers will therefore contain a sufficient variety of questions to suit candidates belonging to either a metalliferous or a coal district.

The subject at large being properly an art, or application of various branches of science, and one in which every question will admit of various degrees of proficiency being shown in the replies, the higher numbers will be awarded only to those answers which exhibit the greater

amount of completeness and accuracy. Curt and vague answers will be but of little value, and exactness will be expected in all that relates to numbers, prices, weights, and measures.

Those who wish to gain a general knowledge of the topics for examination may be recommended to direct their attention to the subjoined heads, viz.:—

First Stage or Elementary Course.

1. Geology and Mineralogy, more particularly those portions of the sciences which bear on the following subjects,—the nature and position in the earth's crust of the useful minerals, the classes rock with which they are severally associated, the special character of heaves, throws, troubles, and all kinds of dislocation; the particular differences between beds and lodes, and their minerals, and the chief features of irregular repositories.
2. The methods of prospecting and searching at surface for ores and other minerals.
3. Breaking rock by manual labour alone; various forms of pick, and of hammer and wedge employed for the purpose. Use of gunpowder and other explosives; precautions to be observed in boring and in firing shots.
4. Depths attained by mines and bore holes in various cases. Geographical distribution of the chief mining districts.
5. Ventilation of mines, why important. Composition of air, carbonic acid gas, and fire-damp; how the latter noxious damps occur, and what precautions against them should be adopted, either for a temporary purpose or permanently. Reasons of a natural circulation of air to some extent being observable in all mines. Various applications of water to aid ventilation. Means of applying heat, or machines for the same purpose.
6. Lighting of workings; principle and construction of the safety lamp.
7. Circumstances under which water enters mines. Working of ordinary pumps; special requirements of pumps for mines. Mode of applying human or horse labour to the winding of water and stuff or mineral; fixing and comparison of the unit of work. Water wheels and steam engines, variety and construction of, as in use for mining purposes.

   Carriage or conveyance along levels and inclines; barrows, tram-plates, rails, tubs, or wagons.

   General features of winding in shafts by machinery.
8. The form and dimensions of shafts applied to various purposes; sinking, and precautions against accident from falls and from collapse of sides.
9. Driving of levels, drifts, and wind-roads; their rate of inclination, breadth, and height in various districts; methods and cost of arching them, and of timbering or wooding.
10. The removal or *exploitation* of mineral after completion, to a certain point, of dead work; stopes and pitches, under various circumstances. Pillar-working at various depths, and other forms of extracting coal or ironstone. Main considerations of safety and economy which have to be studied in adopting a particular plan.
11. Means of security to be adopted in shafts; 1st, as to construction and fixing of ladders; 2nd, as to rules and arrangements where the men ride instead of climbing.

SECOND STAGE OR ADVANCED COURSE.

1. Details as to the form in which the useful minerals are accumulated; stratified deposits; alluvial or stream-works; lodes and their various directions; pipes and other irregular repositories. Examples of remarkable localities; true sectional drawings or profiles to be studied. Examples of heaves, and alleged laws according to which they have taken place. Composition and physical state of the containing rock or "country."
2. Exploring, shoading, and costeaning. Grounds for opinion in the re-opening of old mines; preliminary operations in virgin districts.
3. Breaking of ground; the various implements employed, their form, dimensions, and weight; boring for shots; the various modes of firing charges. Heavy charges, how calculated and fired; rules for ensuring safety. Drilling and coal-cutting machines.
4. Deep boring, under what circumstances applicable,—apparatus for; description of varieties in use; lining of bore-holes.
5. Management and supervision; payment of men employed at mines, at surface and underground, varying in principle with the different classes of operation; reasons for tut-work or piece-work, and tribute or bing-tale under different circumstances. Calculations for cost of driving, sinking, tramming, &c.
6. Physical principles of ventilation; practice of mines where simple natural ventilation is employed; ventilation of large areas and of deep or complicated workings by guiding the natural current; artificial means, and their details, for promoting ventilation. Precautions to be taken under specially dangerous conditions.
7. Illumination, of various kinds, their economy; safety lamps in all their best modifications; circumstances under which they should be employed; precautions in their use.
8. Mechanical division of the subject. Strength of materials used in mines; human and horse power, principles and construction of machines to which they are applied. Hydraulic machines; construction of the water-wheels, turbines, and pressure engines most suitable to the various operations of mining. Steam engines, for pumping and for winding; arrangement and construction of the varieties most in use. Form and dimensions of boilers. Pumps employed in mines, mode of placing them; construction of the lifts; materials and details of the rods, set-offs, counterbalances, cisterns, and catches. Circumstances under which dams are erected in shafts or levels; mode of building them.

   Tubbing of water from shafts; conditions under which it may be done; details of the operation with various materials, wood, brick, stone, cast and wrought iron.

   Rails, waggons, and tubs for underground conveyance; employment of horses and of fixed steam engines for this purpose.

   Raising of the mineral through the shafts; various methods in use; chains, ropes (of hemp or wire), their weight, &c. Details of the best application of drums, cages, guides, keeps, and safety doors. Pulleys and shaft frames or poppet heads; protection against overwinding; safety clutches, &c. in case of breakage of rope.
9. Opening of ground; quarries and open work; driving of levels, various dimensions and directions according to circumstances; sinking of shafts, inclined or perpendicular; advantages of either kind under certain conditions; means of securing levels and shafts by timber or by walling; details of the various methods. Driving or sinking in heavy or running ground.

10. Working excavations; plan of laying them out, and means of security to be adopted whilst they are kept open. This will include the stoping of metalliferous veins, and the various modifications of post and stall, long-work, &c., which are applied to stratified deposits.
11. Travelling in shafts; prevention of accidents by proper fitting and dividing; mode of placing ladders and sollars; lifting machine for men, construction and advantages of.
12. Dressing of minerals. Arrangement of dressing floors. Construction of crusher and stamps; washing of coal; jigging, concentration, and separation of metallic minerals.

Examination for Honours.

Questions will be set at the discretion of the Examiner, who will have regard to a general knowledge of mining as carried on in this and other countries, and may require certificates from employers as to practical work.

Text Books.

The student may be advised among other sources of information to consult the following works:—

Manual of Geology, by J. Phillips. 8vo. 12*s*. 6*d*. (London, Griffin, 1855.)

Report on Cornwall, &c., by H. T. De la Beche. (London, Longman & Co., 1839.)

Laws regulating the Deposition of Lead Ore in Veins, by W. Wallace. 8vo. 25*s*. (London, Stanford, 1861.)

Treatise on Mining Engineering, by G. C. Greenwell. 4to. 50*s*. (London, Spon, 1856.)

Coal and Coal Mining, by W. W. Smyth. 8vo. 7*s*. 6*d*. (London, Strahan, 1869.)

Metallic Wealth of the United States, by J. D. Whitney. 8vo. 16*s*. (London, Trübner, 1854.)

Mining and Metallurgy of Gold and Silver, by J. Arthur Phillips. (London, Spon, 1867.)

Miners Manual of Arithmetic and Surveying, by W. Rickard. (London, Longman, 1859.)

Géologie Appliquée, par A. Burat. 2 vols. 8vo. 17*s*. (Paris, Langlois, 4th ed., 1859.)

Die Lehre von den Erzlagerstätten, von B. von Cotta. 2 vols. 8vo. 15*s*. (Leipzig, Felix, 2nd ed., 1861.)

Besides these the various reports of H. M. Inspectors of Coal Mines, and the evidence given before Committees of the Houses of Parliament on *Accidents in Mines*, may be studied with advantage.

SUBJECT XIX.—METALLURGY.

For the first stage or elementary course the student will be expected to answer questions under the following heads, exclusive of those in italics.

The second stage or advanced course will include these. The student will also be required to make sketches and name unlabelled specimens.

For honours the candidates will be asked questions at the discretion of the Examiner, who will have regard to the present state of metallurgical science as carried on in this and other countries.

Works on Mining, in addition to the above list, which should be kept for reference in a library:—

Section of the Strata, &c., by Westgarth Forster. 1821.

Transactions of the Northern Institute of Mining Engineers.

The Waterworks of London, by Colburn and Man. 7*s.* 6*d.* (Spon, 1867.)

Exploitation des Mines, par C. Combes. 3 vols. 8vo., and Atlas of plates. (Paris, 1844–46.)

Mineral Veins of Swaledale, by Lonsdale Bradley. 8vo., 21*s.* (London, Stanford, 1862.)

Memoirs of Geological Survey of Great Britain. Vol. I., 21*s.*; vol. II., 42*s.* (Longmans, 1848.)

Lehrbuch der Aufbereitungs-kunde (dressing of ores) by Rittinger, (Berlin, Ernstundkorn, 1867.)

Geology of Sandander and Madrid, by Sullivan and O'Reilly. 8vo., 10*s.* (London, Williams and Norgate, 1863.)

History of the Coal Trade, by Matthias Dunn.

Winning and Working of Coal Mines, by Matthias Dunn.

The Goldfields of Victoria, by R. Brough Smyth, 1869. Royal 8vo., 25*s.* (Trübner, Annales des Mines, Paris.)

Introductory Subjects.

Physical Properties of Metals.—Physical State. Action of Heat. Specific Gravity. Crystallization. Varieties of Fracture. Malleability. Ductility. Tenacity. Toughness. Softness. Elasticity. Conduction of Heat and Electricity. Capacity for Heat. Expansion by Heat. Opacity. Lustre. Colour.

Classification of Metallurgical Processes.—Explanation of the terms ore, "native" veinstuff, matrix or gangue, "dressing." Reduction. Smelting. Flux and Slag. Regulus. Speise. Roasting. Distillation. Sublimation. Liquation.

Slags.—Atomic constitution of silicates. Constitution, external characters, brittleness, toughness, colour, and fusibility of slags. The fusibility of certain compounds not containing silica, aluminates, &c. Sesquioxide of iron and lime. Fluor spar as a flux. *Melting points of silicates as indicated by the fusion of alloys of gold and platinum. Supposed sulphosilicates.*

Natural Refractory Materials employed in the Construction of Crucibles, Retorts, Furnaces, &c. Fire Clays.—Approximate composition. Mode of testing. Crucibles.—Earthen or clay crucibles. *Stourbridge clay crucibles. Cornish crucibles. London crucibles. Hessian crucibles. French crucibles. Belgian crucibles.* Graphite, black-lead, or plumbago crucibles. Lining crucibles with carbon. Furnaces.—Sefström's blast furnace. *Deville's blast furnace.* Fire Bricks, &c.—Stourbridge fire-brick. Dinas fire-brick. Sand and sandstones.

Fuel.

The calorific power of fuel. Berthier's process of estimating the calorific power of fuel. The calorific intensity of fuel, and theoretical computation. Wood.—Kinds of wood employed as fuel. Elementary composition of dry wood. Proportion of water in wood. Specific gravity of wood. Proportion and approximate composition of the ashes of wood. The rapidity of growth of wood. Weight of wood. Cutting and storing of wood intended as fuel. Peat or Turf.—Specific gravity of peat. Composition of peat. Approximate composition of the ashes of peat. *Proximate composition of peat.* Extraction and desiccation of

peat. Coal.—Definition of coal. Approximate composition of the ashes of coal. Lignites. *Classification of lignites according to external characters.* Approximate composition of lignites. Bituminous coals. Caking coal. Free burning coal. Cannel coal. Anthracite. *Fibrous and granular matter in coals.* Composition of bituminous coals to be given generally and approximately for each class. *The occurrence of certain metals in peat and coals. Frémy's chemical researches on combustible minerals.* Charcoal.—*Specific heat* and specific gravity of charcoal. Proximate composition of charcoal. Various modes of charcoal burning. Charcoal burning in piles or stacks. *Chinese methods of charring in pits.* Yield of charcoal by volume and by weight. Influence of temperature upon yield. *Theory of charcoal burning in circular and rectangular piles.* Peat charcoal or coke. *Carbonization by superheated steam.* Coke.—Properties of coke. Approximate composition of coke. Presence of water in coke. General principles concerning the preparation of coke. Coking in circular piles, in long piles or ridges, and in large open rectangular kilns. Coke ovens. *Cox's coke oven. Coke oven of the Brothers Appolt. Composition and economic application of the waste gases of coke ovens. Davis' Breezeoven. Mineral charcoal.* Coking of non-caking coal slack by admixture with pitch. *Collection of products of economic value generated during the process of coking.* Desulphurization of coke. Combustible Gases.—Carbonic oxide. Hydrogen. Hydrocarbons.

Comparison of fuels in regard to calorific power. *Calorific power calculated from ultimate composition.*

Copper.

Physical and chemical properties. Specific heat. *Linear dilatation by heat.* Action of heat. Atomic weight. Action of oxygen. Dioxide; protoxide; dioxide and protoxide of copper heated with silica. *Borates of copper.* Disulphide. Disulphide of copper heated with access of air. Theory of the process of heating disulphide of copper with free access of air, or roasting. Disulphide of copper heated in admixture with dioxide, protoxide, or sulphate of copper. *Dioxide of copper heated with protosulphide of iron and silica. Disulphide of copper exposed to the action of hydrogen and water at high temperatures. Metallic copper exposed to the action of the vapour of water at high temperatures. Disulphide of copper heated with carbon, with iron, with zinc, with lead, with tin, with antimony. Copper heated with tersulphide of antimony. Disulphide of copper heated with nitre, with caustic soda, with carbonate of soda, with baryta or lime, with cyanide of potassium.* Copper and dioxide of copper. Copper and carbon. Overpoled copper. Copper and nitrogen. Copper and phosphorus. Copper and arsenic. Copper and silicon. Specific gravity of copper. *Electric conductivity of copper. Influence of various foreign matters on electric conductivity.*

Ores of Copper.—Physical characters and chemical composition of: Native copper. Red oxide of copper. Black oxide of copper. Green carbonate of copper or malachite. Blue carbonate of copper. Vitreous or grey sulphide of copper. Purple copper ore. Copper pyrites or yellow copper ore. True grey copper ore or fahlerz. Chrysocolla. Atacamite. Copper ores of Cornwall and Devon. *Meaning of the word Standard.*

Assaying of copper ores by dry and wet methods. Comparative results by Cornish and wet methods.

Copper Smelting.—In Reverberatory furnaces: The Welsh Process.—Furnaces employed; calciner, melting furnace. The reactions which occur in the process. Calcination; *composition of the gaseous products which escape from the ore-calciner.* Melting of the calcined ore; external

characters, and composition of coarse metal and ore-furnace slag. *Specific gravity of the coarse metal and ore-furnace slag.* Calcination of the granulated coarse metal; Melting of calcined granulated coarse metal; white metal, blue metal, metal-slag. Moss-copper. Roasting; blister-copper, roaster-slag. *Best selected process.* Refining. *Elimination of the following Foreign Metals during the Welsh Process of Copper Smelting.—Arsenic, antimony, tin, nickel, cobalt, gold, and silver. Various proposed improvements in Copper Smelting Furnaces. Napier's process. Method of smelting proposed by MM. Rivot and Phillips. Smelting rich copper slags in a blast furnace.* In Blast Furnaces: In Japan. In Sweden.—Furnaces employed; ore-furnace, black copper furnace, refining-hearth. The processes of roasting or calcination, fusion of the roasted ore, roasting of the regulus from the last operation, fusion for black copper, refining, and toughening. Copper rain. Loss in smelting. *Smelting of copper schist in Prussian Saxony. Copper smelting in Perm in Russia. Cupriferous pig iron. Theory of the process. Kernel-roasting at Agordo.—Composition of the ore. Roasting. Styrian kilns. Mode of charging. Changes which the ore undergoes during roasting. Theory of the process. Wet methods of extracting copper:—Precipitation of copper from solution by iron. Bankart's process. Wet process by M. Escalle. Hähner's patent. Loss of copper.* Impurities occurring in commercial copper.

Zinc or Spelter.

Physical and *chemical* properties. Atomic weight. Action of oxygen. Action of water on zinc. Oxide of zinc. Reduction of oxide of zinc by carbon, carbonic oxide, and hydrogen. *Silicates of zinc. Reduction of silicate of zinc by carbon. Oxide of zinc heated with boracic acid.* Sulphide of zinc heated with access of air, with oxide of zinc, *with carbon, with various metals, in the vapour of water, with carbonic acid,* with nitre or nitrate of soda, with carbonate of potass or soda, *with lime.* Zinc and phosphorus. Zinc and arsenic.

Ores of Zinc.—Physical character and chemical composition of: Calamine. Electric calamine. Blende. *Red zinc ore.*

Methods of assaying Ores of Zinc.

Methods of Extracting Zinc.—*English Process.—Roasting or calcination of the blende. Pots and condensing tubes. Reduction house. Mode of making the pots. Mode of charging the pots, and management of the furnace. Treatment of the rough zinc.* Silesian Process.—Retorts and appendages. Clay nozzles or condensers. Laggins or stoppers. Iron appendages. Description of the furnace. Calciner. Distillation of zinc. Melting of distilled zinc. Belgian Process.—Retorts and appendages. Description of the furnace. *Carinthian Method. Zinc fume. Montefiori furnace.* Foreign matter in commercial zinc. *Proposed improvements in the extraction of zinc.*

Brass.—Definition. Malleability. Process of stamping. Dead-dipping. Physical properties of various alloys of copper and zinc. Manufacture of calamine brass. Direct preparation of brass. Muntz's metal. Defects occurring in brass. Colouring and lacquering.

Iron.

Physical and Chemical Properties. Magnetism. Tenacity or tensile strength. Specific heat. *Dilatation by Heat.* Action of heat. Welding. "Burnt Iron." Crystalline and fibrous iron. Effect of cold hammering upon iron. Atomic weight. Iron and oxygen.—Protoxide; sesquioxide or red oxide; hydrated sesquioxide; magnetic oxide; iron scale, or hammer slag. *Ferric Acid.* Iron and Water.—Preservation of iron from rust. Iron and Sulphur.—*Disulphide;* protosulphide; *protosulphide exposed to the action of vapour of water at a high tem-*

perature. Protosulphide of iron heated with carbon, with sesquioxide of iron, with sulphate of protoxide of sesquioxide of iron, with protoxide of lead, with other metallic sulphides, with silica, with silica and carbon. Sesquisulphide; bisulphide; or iron pyrites. Magnetic pyrites. Sulphate of protoxide of iron, copperas, or green vitriol. *Neutral tersulphate of sesquioxide of iron.* Sulphides of iron roasted with access of air. Iron and Nitrogen.—Results of experiments. *Passivity of iron.* Iron and Phosphorus.—Phosphides of iron. *On the action of carbon on iron containing phosphorus.* Phosphate of protoxide of iron. Phosphate of sesquioxide of iron. *On the action of iron at a high temperature upon phosphate of lime in the presence of carbon.* Ditto in the presence of carbon and free silica. *On the action of phosphorus on iron containing sulphur. Iron and Arsenic. Case-hardening of iron or steel by arsenic.* Silicon. *Silicon and nitrogen.* Manganese and Silicon. Iron and Silicon.—Reduction of silica by carbon in the presence of oxide of iron and other bases. Protoxide of iron and silica. Reduction of silicate of protoxide of iron by carbon. *Silicate of sesquioxide of iron. Tribasic silicate of protoxide of iron heated with access of air. Liquation of silicate of protoxide of iron containing phosphorus. Protoxide of iron and boracic acid. Sesquioxide of iron and boracic acid.* Iron and Carbon.—Modes of effecting the combination of carbon with iron. Cementation. *Action of carbonic oxide upon iron. Action of solid carbon upon iron. In an atmosphere of carbonic oxide. In an atmosphere of hydrogen.* Amount of carbon in iron. Maximum amount of carbon capable of being taken up by pure iron. *Iron, manganese, and carbon.* Modes of existence of carbon in iron, grey, white, and mottled cast iron. Chill-casting. Spiegeleisen, or specular cast iron. *Action of silicon and of sulphur on iron containing carbon. Abstraction of silicon from cast iron by fusion with sesquioxide of iron alone, and with the addition of manganese.* Carbonate of protoxide of iron. *Action of dilute sulphuric or hydrochloric acid on white and grey cast iron.* Action of sea water on cast iron.

Alloys of Iron.—Iron and copper. Iron and zinc. Process of zincing or galvanizing iron. Iron, copper, and zinc. Keir's patent. *Aich-metal. Sterro-metal.* Iron and tin. *Hardening the tops of rails with tin. Stirling's patent. Action of tin on cast iron.* Iron and manganese; *titanium; lead; bismuth; nickel; cobalt; mercury; silver; gold; platinum; rhodium; aluminium; chromium; tungsten.*

Ores of Iron.—Physical properties and chemical composition of:—Magnetic oxide of iron, magnetite. *Franklinite.* Red hæmatite, red ore or anhydrous sesquioxide of iron. Brown hæmatite, brown iron ore, or hydrated sesquioxide of iron. Spathic carbonate, or sparry iron ore. Argillacious iron ores, clay or clayband ironstones.

Assaying of iron ores by dry and wet methods.

Direct Extraction of Iron in the Malleable State from the Ore.—Iron Smelting in India, Burma, Borneo, Africa, and Madagascar. Catalan Process; trompe, or blowing machine. *Its advantages and disadvantages.* Water wheel, hammer, and anvil. *Theory of the process. Conditions affecting the quality of the iron produced.* Characters of the iron produced. *The Osmund furnace.* Stückhofen or High Bloomery Furnace. *Clay's process. Renton's process. Chenot's process.* Indirect Extraction of Iron in the State of Cast Iron from the Ore.—*Swedish charcoal blast furnace; mine kiln. Pressure of the blast. Temperature of the blast. Iron ores employed. Most important iron mines in Sweden. Smelting of lake and bog iron ores in Sweden.* Description of the modern blast furnace; foundation, hearth, twyer openings, twyer, tunnel head, bracing, blast main, and blast pipes, *blast engines.* Cinder tubs. *Chemical phenomena of the modern blast furnace.* Hot Blast.—Neilson's

patent. When first put into operation. Apparatus for heating the blast. *Neilson's first apparatus. Cast-iron tubular oven.* Syphon pipe, *box-foot pipe, spiral pipe, and pipe-within-pipe oven. Gas oven. Round or oval oven. Theory of the hot blast.* Saving of fuel. *Water-twyers.* The Gases of Iron-smelting Blast Furnaces.—Composition of the gases of the Furnace. *Production of cyanogen in the blast furnace. Temperature of the blast furnace at different depths.* Utilization of the gases escaping from blast furnaces. "The waste gas." Modes of taking off the gases with open-mouthed and with close-mouthed furnaces. *Solid matter carried over with the waste gas.* The best form of the blast furnace. Decrease in volume which the materials undergo during their descent. Elliptical furnace. *Rectangular or Rachette furnace. Blowing in a blast furnace.* Tapping. Sand-bed for casting. Derangements in the working, scaffolding, and slips. Loss of iron in the slag. *Indications afforded by colour of slags. Spontaneous disintegration. Potash in slags. Accidental products of blast furnaces. Silica. Furnace cadmia or calamine. Cyanonitride of titanium. Graphite or kish.* Reduction of phosphoric acid in the blast furnace, and passage of the phosphorus into the pig iron. Economical application of blast furnace slags. *Effects of long continued heat upon sandstone in the hearth bottom. Substitution of lime for limestone as a flux. Application of chloride of sodium.* Explosions in blast furnaces. Poisoning by gas accidentally escaping from blast furnaces. Yields of blast furnaces.

Various kinds of Pig Iron.—Spiegeleisen. Pig iron made from magnetic iron ore. Do. from red hæmatite. *Do. from brown hæmatite. Pig iron produced exclusively from Northamptonshire ore.* Do. wholly or chiefly from argillaceous iron ore of the coal measures. *Yorkshire. Derbyshire. South Staffordshire. North Staffordshire. South Wales. Do. from Cleveland ore. Titaniferous pig iron.*

Production of Malleable Iron from Cast Iron.—South Welsh process; the hollow fire. Swedish Lancashire Hearth; *Walloon process, as conducted in Sweden. Carinthian process.* Slags or cinders produced in finery processes. Running out fire or refinery; composition of refined iron; do. refinery slags or cinders. Puddling; puddling furnace. Invention of iron bottoms; manipulation; theory of the process; composition of tap cinder; invention of the boiling process; double puddling furnaces. *Mechanical puddling. Application of waste blast furnace gas to puddling. Siemens' gas puddling furnace; principle of the furnace. The gas producers. Construction. Puddling with dried wood. Stamping and assorting puddled balls. Utilization of the waste heat of puddling furnaces.* Working of the Ball.—Forge hammers; tilt hammers. Helves or lift hammers. *Steam forge hammers; Nasmyth's. Condie's.* Squeezers; crocodile. Horizontal rotary. Vertical rotary. *Brown's shingling machine.* Puddling or puddle rolls. *Composition of puddled bars.* Working of the Puddled Bar into Merchant or Finished Iron.—Reheating furnace; with coal as fuel. With gaseous fuel, or gas-welding furnace. Piling. Accidents in rolling mills. *Yield of puddled and finished iron.* Manufacture of rails. *Composition of the cinder from the reheating furnace.*

Varieties of Sheet Iron and Slit Rods.—Tin plates. Charcoal plates. *Coke plates. Belgian sheets. Russian sheets. Slit rods.* Special Qualities of Iron.—South Yorkshire. Process of manufacture at Lowmoor, Bowling, and Farnley. South Staffordshire. *Swedish iron. Dannemora. Russian iron.* Boat plates. *Armour plates; rolled; hammered. Mending broken rolls.*

Permanent expansion of cast iron by exposure to long continued heat at or above redness. Dilatation of cast iron by heat.

Production of Steel.—By the Addition of Carbon to Malleable Iron: In the direct reduction of iron ores at one operation. In the Catalan

process. In crucibles. In converting furnaces. Carburization of iron as a distinct process; carburization of pulverulent iron. *Chenot's process.* Carburization of bar iron. Converting furnace. *Carburization by gaseous compounds of carbon.* Carburization by fusing compact iron with carbonaceous matter; *Hindoo process. Wootz. Mushet's steel.* By the partial Decarburization of Cast Iron:—By fusing in hearths. *By puddling.* Composition of puddled steel. *Uchatius process.* By cementation. By Fusion of Pig Iron with Malleable Iron:—*Immersion of malleable iron in molten cast iron.* By Blowing Atmospheric Air through Molten Pig Iron.—Bessemer process. Description of the apparatus. *Parry's process of manufacturing iron and steel.* Casting of Steel.—Furnaces and crucibles. Fusion of steel in the reverberatory furnace. *The addition of manganese in the casting of steel.* Manipulation of Steel.—Hardening and tempering steel. *Metallic baths for the use of working cutlers.* Theory of hardening and tempering steel. Hammering steel. Welding steel. Shear steel. *Casting steel on wrought iron. Damaskeening.*

Lead.

Physical and Chemical Properties. *Dilatation by heat. Conductivity for heat and electricity.* Action of heat. Autogenous soldering. Action of air, of water, *of carbonic acid, of dioxide of copper, and of acids upon lead.* Protoxide; mode of formation by dry and wet methods. Physical characters of massicot and litharge. Action of heat. Action of carbon, *of hydrogen, and of carbonic oxide.* Fusibility with metallic oxides. *Action of metals when heated with protoxide of lead. Dioxide;* Binoxide; mode of formation. *Sesquioxide;* Red lead; process of manufacture. Physical and *chemical* properties. Action of heat. *Action of acids.* Sulphide; physical and chemical properties. Action of heat and air upon sulphide of lead; in the presence of iron pyrites and of blende. *Action of hydrogen and of steam upon sulphide of lead.* Action of protoxide of lead, silicates of protoxide of lead, *of alkalies, of carbonate of soda,* of cyanide of potassium, of alkalies and alkaline carbonates and carbon, of lime and carbon, *of peroxide of iron and carbon,* of nitrate of potash, *of chloride of sodium,* of iron, *of tin,* and *of copper* when heated with sulphide of lead. Combination of sulphide of lead with other sulphides. *Subsulphides of lead.* Sulphate; physical and *chemical* properties. Action of heat. Action of carbon, of iron, of lead, of protoxide of lead, of sulphide of lead, *of chloride of lead,* of silica, of lime, of *chloride of sodium,* and of cyanide of potassium, upon sulphate of lead. *Sulphate of lead and fluor spar.* Lead and Phosphorus. Phosphide; phosphates. Lead and Arsenic. Action of arsenious acid on lead. Arseniate of lead. Silicates of Protoxide of lead. Methods of formation. Fusibility. Action of carbon, of sulphur, *of sulphide of iron,* of iron, *of lime, of lime and carbon,* of peroxide of iron and carbon upon silicates of protoxide of lead. *Silicates of protoxide of lead and potash. Silicates of protoxide of lead and lime. Silicates of protoxide of lead, lime, and alumina. Borates of protoxide of lead.* Carbonate; white lead. Action of heat.

Alloys of Lead.—Lead and antimony; zinc; *copper; mercury; gold;* silver.

Ores of Lead.—Physical character and chemical composition of: Galena or sulphide of lead. Cerusite, or carbonate of protoxide of lead. Anglesite or sulphate of protoxide of lead. Pyromorphite or phosphate of protoxide of lead. Mimetisite or arseniate of protoxide of lead. Minerals occurring with galena.

Methods of assaying Lead Ores.

Extraction of Lead from the Ore.—In air furnaces: Old English process. *Peruvian process. Spanish process.* In blast furnaces: *Hin-*

doo process. Ore hearth.—Construction of the furnaces, method of working, nature of the products, *chemical composition of the products and chemical reactions which occur in the process. American ore hearth.—Peculiarity. Advantages.* German method with iron, or "precipitation process."—Description of furnaces, mode of working, nature of the products, *chemical composition of the products and chemical principles involved. Composition of lead speise.* Smelting of regulus. German method with silicate of protoxide of iron, or iron refinery slags. In reverberatory furnaces: Derbyshire furnace.—Process, description of the furnace, nature and *composition of the products and chemical reactions involved.* Flintshire furnace.—Process, peculiarities, nature of the products, *chemical composition of the products and chemical reactions which occur. Action of lime.* Cornish process.—Description of "calciner," and of "flowing furnaces." Nature of the products. *Chemical composition of products. Action of iron.* Bleiberg process.—Peculiarities of the process, character of furnace. Method of working, nature of the products and *chemical composition of products. Modifications of process.* Smelting of lead slags: Slag hearth.—Description of furnace, mode of working, *composition of products and chemical reactions involved.* Spanish slag hearth.—Description of furnace, mode of working, nature of products and *chemical composition of products.* Smelting of lead fume. Reduction of litharge. Softening of hard lead. Smelting of sulphate of protoxide of lead ore. *Composition of the products.*

Extraction of Silver from Lead.—Pattinson's process.—*Theory of the process,* methods of working, description of the apparatus and mechanical appliances. *Limit of concentration. Effect of foreign metals.* Parkes' process.—Methods of working. *Principles involved.* English process of cupellation.—Construction of furnace, mode of conducting the process, nature of the products, *chemical composition of the products and chemical reactions involved.* German process of cupellation (abtreiben).—Description of furnace, mode of conducting the process, nature of the products and *chemical composition of products.* Refining of "Blicksilber."—In open test. Under a muffle.

Apparatus for condensing Lead Fume. Physical properties and *chemical composition* of lead fume. Varieties of Lead in Commerce. Impurities occurring in lead. *Methods of testing for metals present in lead.*

SILVER.

Physical and chemical properties. *Dilatation by heat. Conductivity for heat and electricity. Specific heat.* Action of heat, of heat and air, of nitre, *of chloride of sodium, of oxide of copper,* of protoxide of lead, *of sulphate of protoxide of copper,* and of acids upon silver. Silver and Oxygen. Protoxide; physical and chemical properties. Methods of producing. Action of heat. Action of carbon. *Action of chlorine.* Silver and Sulphur. Sulphide; physical and chemical properties. Modes of formation. Action of heat. Action of heat and air. Action of heat and air in the presence of iron pyrites, copper pyrites, *disulphide of copper, blende, and galena. Action of hydrogen, of steam,* of acids, of nitre, of iron, of lead, *of copper, and of mercury upon sulphide of silver.* Combination with other sulphides. "*Oxidized silver" process.* Sulphate; physical and chemical properties. Mode of producing. Action of heat. Action of chloride of sodium. Mode of formation of compound of sulphide and sulphate of silver. *Solubility in water. Sulphite;* hyposulphite; method of preparation. *Action of hydrochloric acid upon.* Action of hyposulphite of soda on chloride of silver. Nitrate; physical and chemical properties. Action of heat. Method of separation from nitrate of protoxide of copper. *Action of carbon and phosphorus upon solutions of.* Silver and Chlorine. Chloride; physical and chemical properties. Methods of formation by dry and wet pro-

cesses. Methods of reduction by carbonate of soda, by carbonate of lime, by zinc. *Action of hydrogen*, of acids, of chloride of sodium, *of cyanide of potassium*, of iron, lead, *copper*, *tin*, *antimony*, *arsenic*, *mercury*, of sulphur, of metallic sulphides, and of protoxide of lead upon chloride of silver. *Silver and bromine. Silver and iodine. Silver and phosphorus. Silver and arsenic.*

Alloys of Silver.—Silver and lead; copper; gold; *zinc; palladium; antimony.*

Ores of Silver.—Physical characters and chemical composition of: Native silver. Silver glance or sulphide of silver. Sulphide of silver and copper. Antimonial silver. Ruby silver or sulphide of silver and antimony. Brittle silver glance. Sulphide of silver and arsenic. Polybasite. Sulphide of silver, antimony, and lead. Horn silver or chloride of silver. *Bromide of silver. Iodide of silver. Nature of metalliferous minerals containing silver.*

Assaying of ores and alloys of silver by the dry and wet methods.

Methods of Extraction.—Extraction of silver from argentiferous copper: Liquation process, or "Saigerarbeit."—Description of furnace. Mode of operation. Nature of the products. *Chemical principles involved.* Extraction of silver from the ore: Mexican amalgamation process.—Apparatus employed, materials used, method of working, nature of the products and *chemical principles involved. Specialties of the process.* Working of the silver amalgam. *Application of copper amalgam. Loss of silver in the process. Chloride of silver process.* Freiberg amalgamation process.—Description of furnaces and apparatus, Mode of working and *chemical principles involved. Composition of silver amalgam.* Method of separating the silver from the amalgam. *Amalgamation of argentiferous speise. Amalgamation of argentiferous copper regulus.* Extraction of silver from argentiferous regulus: Ziervogel's process.—Description of the furnaces and apparatus employed, method of operation, nature of the products, and *chemical reactions involved in the various operations. Specialties of the process.* Augustin's process.—Description of the process and *chemical principles involved.* Von Patera's method.—Apparatus used, materials employed, products obtained, and *chemical reactions in the process.* Extraction of silver from ore by means of lead: Furnaces used, method of working, nature of the products. *Chemical composition of the products and chemical reactions involved.* Methods of plating or silvering: Old methods. On copper. On steel. Method of silvering without the use of "batteries." *Stripping of silver plate.*

Varieties of silver in commerce. Metals occurring in silver. *Methods of testing silver for foreign metals.*

Gold.

Physical and chemical properties. Dilatation by heat. *Conductivity for heat and electricity.* Action of heat. *Protoxide; physical properties, mode of preparation, action of hydrochloric acid.* Teroxide; physical and chemical properties. Protosulphide; methods of formation, physical characters. Tersulphide; mode of producing, physical characters, action of heat, *of chlorine, of hyposulphite of soda, and of potash upon tersulphide of gold. Gold and phosphorus. Gold and arsenic.* Gold and chlorine; *protochloride;* terchloride; methods of formation. Action of oxalic acid, of sulphate of protoxide of iron, *of terchloride of antimony and of chloride of arsenic* on solutions of chloride of gold. *Preparation of purple of Cassius. Method of colouring "ruby glass."*

Alloys of gold.—Gold and copper; *zinc;* silver; lead; *tin; antimony; iridium; platinum; palladium;* copper and zinc; silver and copper.

Use of the touchstone. Definition of the terms "standard" and "carat."

Ores of Gold.—Native gold; physical character and chemical composition. *Various metalliferous minerals containing gold.* Auriferous quartz.

Assaying of ores and alloys of gold by dry and wet methods.

Methods of Extraction.—Amalgamation of quartz containing gold; apparatus employed, mode of working, nature of the products, and method of extracting the gold from the amalgam. *Longmaid's process. Anossow's process by means of iron. Plattner's process by chlorine.* Melting of gold dust. Sweep refining.

Separation of Gold from Silver and Copper. Parting.—Dry methods: *By litharge and sulphur.* By cementation; description of the process. *Chemical reactions involved. By sulphur.* Wet methods: Nitric acid process; apparatus used, method of working, and *chemical principles involved.* Sulphuric acid process; apparatus employed, mode of working, and *chemical reactions involved. Modifications of the process. Refining gold containing silver by chlorine.*

Varieties of Gold in Commerce. *Methods of detecting copper, silver, lead, tin, antimony, platinum, palladium, and iridium in gold.*

Mercury or Quicksilver.

Physical and chemical properties. Action of heat, of air, *of acids, and of chlorine upon mercury. Suboxide; physical and chemical properties.* Protoxide or red oxide; mode of formation, physical and *chemical* properties. Action of heat. *Subsulphide; physical and chemical properties.* Protosulphide or vermilion; methods of preparation, physical and *chemical* properties. Action of heat, of heat and air, *of hydrogen,* of iron, of lime, *of alkalies, of chlorine, and of acids upon protosulphide.* Subchloride; physical and *chemical* properties. Protochloride; physical and *chemical* properties.

Amalgams.—Mercury and silver; gold; copper; *iron;* sodium.

Ores of Mercury.—Physical characters and *chemical composition* of: Native mercury. Cinnabar. *Native amalgan. Fahlore containing mercury. Nature of other minerals containing mercury.*

Methods of assaying of ores of mercury.

Methods of Extraction.—Description of furnace, method of operation, nature of the products, and *chemical reactions involved* in the following methods: *Huanacavelica process. Almaden process. Idrian process.* Leopold furnace process. Alberti process. Hähner's furnace process. *Gallery furnace process. Fahlore process.*

Impurities present in mercury. Methods of testing mercury for foreign metals. Modes of purifying commercial varieties of mercury. Water gilding.

Cobalt.

Physical and *chemical* properties of the metal. Methods of preparation. Protoxide; mode of formation, physical and *chemical* properties. *Action of hydrogen.* Sesquioxide; methods of preparation, physical and *chemical* properties. *Action of carbon.* Physical and *chemical* properties and mode of producing the compounds of cobalt and arsenic. *Arseniate of cobalt.*

Ores of Cobalt.—Physical character and *chemical composition* of: Cobalt glance. Smaltine. *Cobalt bloom. Nature of other minerals containing cobalt.*

Methods of estimating cobalt.

Cobalt products.—Smalts; mode of preparation. Apparatus used. Nature of the products. *Chemical composition of the products. Chemical principles involved* in the manufacture. Uses of smalts and oxide of cobalt. Silicate of protoxide of cobalt; mode of obtaining. Physical

characters. *Rinmann's green; mode of preparation. Nature of. Chemical composition. Thenard's blue; mode of preparation. Nature of. Chemical composition. Phosphate of cobalt.* Printers' blue; application. Mode of preparation. Nature of. *Chemical composition.*

Nickel.

Physical and *chemical* properties of the metal. Physical and *chemical* properties of protoxide and peroxide of nickel. *Action of hydrogen. Action of carbon.* Physical and *chemical* properties and mode of obtaining compounds of nickel and sulphur. Physical and *chemical* properties of the compounds of nickel and arsenic. Nickel speise; *chemical composition. Pottery nickel. Action of heat and air upon arsenide of iron, cobalt, and nickel.*

Alloys of Nickel.—German silver; mode of preparation, physical characters and composition of the commercial varieties. *Nature and composition of other alloys containing nickel.*

Ores of Nickel.—Physical characters and *chemical composition* of: Kupfernickel. Nickeliferous pyrites. Arsenical nickel. Nickel glance. *Millerite. Nature of other minerals containing nickel. Meteoric iron.*

Methods of assaying nickel ores.

Methods of Extraction.—Apparatus employed, mode of working, nature of the products, and *chemical reactions involved.*

Commercial varieties of nickel. *Foreign metals occurring in nickel.*

Arsenic.

Physical and *chemical* properties. Action of heat, and of heat and air upon the metal. Physical and *chemical* properties, and methods of preparation of the compounds of arsenic and oxygen. *Action of light.* Action of heat. Action of carbon, of *hydrogen,* and of *carbonic oxide upon arsenious acid.* Physical and *chemical* properties, and methods of obtaining the compounds of arsenic and sulphur. Action of heat, *of carbonate of soda and carbon, and of cyanide of potassium upon the sulphides of arsenic.*

Ores of Arsenic.—Physical characters and *chemical composition* of: Native arsenic. Realgar. Orpiment. Mispickel. Arsenical iron pyrites. *Nature of other minerals containing arsenic.*

Methods of estimating arsenic.

Methods used for obtaining White Arsenic.—Description of apparatus, methods of working, nature of the products and *chemical reactions involved.* Methods of refining white arsenic; description of apparatus, mode of working, and nature of products. *Preparation and chemical composition of yellow arsenic glass. Preparation and chemical composition of red arsenic glass.* Preparation of metallic arsenic.

Applications of arsenic and its various compounds. Nature and *chemical composition* of Emerald Green and *Scheele's green. Opalescent glass. Mode of producing Green bronze.*

Antimony.

Physical and *chemical* properties of the metal. Physical and *chemical* properties, and methods of formation of the following oxides of antimony:—Teroxide; action of carbon, *of cyanide of potassium,* and of sulphur, upon teroxide of antimony. Intermediate oxide. Antimonic acid; action of heat. Tersulphide; methods of formation. Physical and *chemical* properties. Action of heat, of heat and air, *of steam,* of carbon, of *carbonic oxide,* of cyanide of potassium, of nitre, of iron, of *copper,* of *tin,* and *of acids* upon tersulphide of antimony. Glass of antimony. Liver of antimony.

Alloys of Antimony.—Antimony and lead. Action of heat and air upon alloys of antimony and lead. *Antimoniates of protoxide of lead. Naples yellow.* Composition of type metal and stereotype metal. *Antimony and iron; copper; "Regulus venus"* tin. *Other alloys containing antimony used in the arts.*

Ores of Antimony.—Physical characters and *chemical composition of: Native antimony.* Antimony glance. Valentinite. Antimony ochre. *Red antimony ore. Nature of other minerals containing antimony.*

Assaying of ores of antimony.

Methods of Extraction.—Apparatus used, methods of working, nature of the products, *Chemical composition of the products,* and *chemical reactions involved* in the following methods:—Liquation process. Reduction by iron, English process. French method.

Foreign metals occurring in antimony. Methods of testing for foreign metals.

TIN.

Physical and *chemical* properties of the metal. Action of heat, of air, of heat and air, and *of acids* upon the metal. *Action of tin on various metallic oxides.* Physical and *chemical* properties of the following:—Protoxide; *Sesquioxide;* Binoxide; *"Putty powder." Stannate of soda.* Physical and *chemical* properties of the following:—Protosulphide *Persulphide; Protochloride; Perchloride.* Tin and Arsenic.

Alloys of Tin.—Tin and copper. Physical properties and composition of bronze, Bell metal, and Speculum metal. Casting of Bronze. Tin and antimony. Britannia metal. *Tin and zinc.* Tin and lead. Pewter. Solder. Soldering. *Tin, lead, and copper. Roman pot metal. Other alloys employed containing tin. Bearing metal. Amalgam for electrical machines. Tin bronze. Tinning of brass pins.*

Ores of Tin.—Nature and *chemical composition* of Cassiterite. "Stream tin." "Mine tin." "Wood tin." *Tin pyrites or bell-metal ore. Minerals occurring with tin ores.*

Assaying of tin ores.

Smelting of Tin Ores.—In reverberatory and blast furnaces.—Description of furnaces used, methods of working, nature of the products, *chemical composition of the products, and chemical reactions involved.* Refining of tin. *Oxland's process.*

Commercial Varieties of Tin.—Common tin. Refined tin. Grain tin. Block tin. *Foreign metals occurring in tin. Methods of testing for foreign metals.*

BISMUTH.

Physical and *chemical* properties. Action of heat, of air, *of steam, and of acids* upon bismuth. Teroxide; mode of formation. Physical and *chemical* properties. Action of carbon. *Protoxide.* Tersulphide; methods of formation. Physical and *chemical* properties. Action of heat. *Action of hydrogen. Action of metals when heated with Tersulphide of Bismuth.*

Alloys of Bismuth.—Nature and composition of alloys containing bismuth employed.

Ores of Bismuth.—Names of various minerals containing bismuth. *Physical characters and chemical composition of minerals containing bismuth.*

Methods of estimating bismuth.

Methods of Extraction.—Apparatus used. Description of processes, *and chemical actions involved in the various methods. Old methods.* Recent methods. Plattner's furnace.

Foreign metals occurring in bismuth. Methods of testing for foreign metals.

Platinum.

Physical and chemical properties of the metal. *The properties of Platinum black and Spongy platinum, and methods of formation.*

Ores of Platinum.—Native platinum. Physical characters. *Metals occurring in. Minerals associated with.*

Methods of Extraction.—Wet method. Deville's method. Melting of platinum. *Working of platinum.*

SUBJECT XX.—NAVIGATION.

First Stage or Elementary Course.

General Notions.—Figure of the earth; earth's diameter, axis, poles. Meridians; equator, equinoctial. Parallels of latitude; latitude, longitude. Difference of latitude; difference of longitude. Rhumb line; course; nautical distance, meridian distance; departure.

Examples of differences of latitude and longitude. The meridian distance is equal to the difference of longitude multiplied by cosine of latitude. When a ship is sailing on a parallel of latitude:— (1), given the distance made good and latitude to find the difference of longitude; (2), given the difference of longitude and the latitude to find the distance; (3), given the meridian distance and the difference of longitude to find the latitude.

The Compass.—Description; Points. Number of degrees, minutes, and seconds in a point, ¼ point, ½ point, ¾ point. To reduce points and parts of points into degrees, minutes, and seconds, and conversely.

Variation of the Compass: easterly, westerly. How to be allowed (1) when it is required to find the true from compass course; (2), to find compass course from true.

Causes of Local Deviation.—How the amount of local deviation is ascertained practically; how allowed. Examples of correction of courses for variation and deviation.

Leeway.—Definition. Starboard tack, port tack, close-hauled. How leeway is to be allowed. Examples.

The Log.—Description. How divided.

Plane Sailing.—Construction of figures. Proof of formulæ used in plane sailing, viz., connecting nautical distance, difference of latitude, departure and course. Examples.

Traverse Sailing.—Definition of a traverse. To resolve a traverse. Construction of traverse table. Examples.

Middle Latitude Sailing.—To prove the formulæ used. Examples.

Second Stage or Advanced Course.

Mercator's Projection and Chart.—Description. How meridians are laid down, and divided for representation of the latitudes. Chief value of the chart is:—"That the angle which a straight line joining any two "places on a chart makes with the meridians is equal to that which the "rhumb line joining the same two places on the globe makes with the "meridians": proof of this.

To draw a Mercator's chart. To find the latitude and longitude of any place on the chart, and *vice versâ*, from the latitude and longitude to find its place on the chart. To find the course between two places on the chart. To find the ship's place by the bearing of two known places or headlands. To lay down a rock, island, or headland from observed bearings. To find the distance between two places on the chart. From the course nd distance run to find the place on the chart.

Proofs of rules used in Mercator's sailing. Examples.

Local Deviation.—More accurate account of the causes of sub-permanent and induced magnetism. Laws of induced magnetism in a ship. Semicircular and quadrantal deviation. Description of modes for ascertaining the amount of deviation.

Great Circle Sailing.—Given the latitude and longitude of two places to find the distance between them on a great circle. To find also the latitude and longitude of the vertex. To find a succession of points on a great circle between two places. Examples.

Errors to which the log is liable. Having given the apparent distance run with given known errors in log line and glass, to find the true distance.

To find the difference of longitude made on a traverse. Sea journal. Taking a departure. Log-board and log-book. Day's work. Examples.

Examination for Honours.

In addition to the above there will be required—

The proof of the rule for finding meridional parts, viz.:—

$$m=3\cdot8988495+\log.\ (\log.\ \cot.\ \tfrac{1}{2}\ \text{colat.}-10).$$

Problems in Marine Surveying, &c.

Text Books.

Candidates for examination in this subject are recommended to use the following books:—

A Treatise on Navigation and Nautical Astronomy, by J. Riddle (*with Tables*), 2 vols., 11*s.* 6*d.* Tables separate, 5*s.*
(London, Simpkin & Marshall, 8th ed., 1864.)

Navigation and Nautical Astronomy, by H. W. Jeans, in two parts, 12mo., 5*s.* each, or in one vol. 9*s.*
(London, Longman, new ed., 1860.)

Or, *Navigation and Nautical Astronomy*, by Merrifield & Evers.
(London, Longman & Co.)

Nautical Tables for British Seamen, by James Inman, 8vo., 14*s.*
(London, Rivington, 1862.)

For reference the following books may be consulted:—

1. *Navigation and Nautical Astronomy for British Seamen*, by James Inman, 8vo. (London, Rivington.)
2. *Practice of Navigation*, by D. Raper, R.N.
3. *Navigation and Nautical Astronomy*, by — Bowditch. (U.S. America.)
4. *Glossary of Navigation*, by J. B. Harbord, M.A. (London and Edinburgh, W. Blackwood & Sons.)
   Sold by J. D. Potter, Admiralty Chart Agent, London.
5. *Outlines of Astronomy*, Sir J. F. W. Herschell.

SUBJECT XXI.—NAUTICAL ASTRONOMY.

First Stage or Elementary Course.

Definition.—Circles of declination or hour circles. Equinoctial points. Ecliptic, obliquity of ecliptic, signs of the zodiac. Precession of the equinoxes, circles of celestial latitude. Latitude and longitude of a celestial body.

Declination, right ascension, right ascension of the meridian, sensible and rational horizon. Zenith, nadir, vertical or azimuth circles or circles of altitude. Altitude, azimuth, and amplitude of a heavenly

body. Parallels of altitude. Six o'clock hour circle. Prime vertical. Colatitude.

Proof that the altitude of the elevated pole is equal to the latitude of the observer. Illustration by diagrams; projections on the meridian and horizon.

Time. Apparent noon, apparent solar day, mean solar day, mean noon, equation of time. Sidereal day. To convert intervals of mean time into sidereal time, and *vice versâ*. Illustration of these definitions by diagrams. Difference between civil and astronomical reckoning of time. To convert arc into time, and time into arc.

To find the Greenwich date, the time at any other place and longitude being given. To take out the right ascension of the mean sun for a given mean Greenwich date.

The corrections of altitudes:—

1. *Dip.*—Proof that dip in minutes$=\cdot9784\sqrt{h}$, h being reckoned in feet.
2. *Refraction.*—Why necessary? Show generally how it is measured. Refraction $=57''$ tan Z.D nearly.
3. Correction for semi-diameters.
4. *Parallax.*—Horizontal parallax $\times$ cos. apparent altitude $=$ parallax in altitude.

Sextant.—Description. Adjustments, how to make them. Index error, how it may be found.

Chronometer.—Error and rate. Reading of the chronometer.

Equation of time.—How it is to be applied to the mean time to obtain the apparent time, and conversely.

To find the latitude by a meridian altitude of the sun: proof of the rule and examples. To find the latitude by a meridian altitude of a star.

To find the mean time at any place and also the Greenwich mean time of the passage of a star over a given meridian on a given day, and the distance at which it passes north or south of the zenith. To find the latitude by the altitude, (1), of the sun; (2), of a star below the pole. To find the latitude by the altitude of the pole star. To find the variation or local deviation by the observed azimuth or amplitude of the sun. Proof of the rules for finding the azimuth and amplitude. Applications of the rules to find the variation or deviation.

To find the hour angle of a heavenly body east or west of the meridian. To compute the mean or apparent time at any place from the observed altitude of a heavenly body. To find the error and rate of the chronometer. To find the longitude by the chronometer.

SECOND STAGE OR ADVANCED COURSE.

For the advanced course, in addition to the above, the candidate will be required:—

To find the latitude by the moon:—

1. To find the mean time, and Greenwich date, of the moon's meridian passage on a given astronomical day in a given altitude.
2. To find the semidiameter and horizontal parallax of the moon for a given Greenwich date (mean time) from the Nautical Almanac.
3. To take out the moon's declination from the Nautical Almanac.
4. To find the latitude by the meridian altitude of the moon above and below the pole. Examples.

To compute the reduction of the horizontal parallax.

To define the angle of the vertical, and to describe the method of computing it.

To compute the augmentation of the moon's semi-diameter.

To prove the following rules:—

1. For the reduction of the altitude of any celestial body observed at

one place to what it would have been if observed at the same instant at another place.
2. For finding the latitude by the altitude of the pole star.
3. For finding the latitude by altitudes of any celestial body near the meridian.
4. For finding the hour angle of a celestial body from the observed altitude.
5. For finding the rising and setting of celestial bodies and twilight.
6. The error of hour angle for small errors in observed altitude, when least.
7. For finding the latitude and longitude by means of two altitudes.
8. For computing the altitude of a given celestial body for a given time.
9. The method of clearing a lunar distance from the effects of parallax and refraction.

And to work practical examples of all these rules.

To compute the latitude and longitude by double altitudes—1. By Ivory's method. 2. By the direct method.

To find the error of the chronometer by equal altitudes of the sun or of a fixed star. To compute the apparent altitude from the true altitude. To compute the longitude by an observed lunar distance. To describe Summer's method for finding latitude and longitude. Cyclones and tides.

Examination for Honours.

In addition to the above:—

Method of computing the moon's right ascension from an occultation of a fixed star. Longitude by eclipses of Jupiter's satellites. To find the position of an unknown star or comet by its distances from two known stars. Astronomical problems.

Text Books.

For studying this subject the same books are recommended as have already been given at the end of the courses on *Navigation*.

SUBJECT XXII.—STEAM.

First Stage or Elementary Course.

In the first paper the questions will be restricted to those portions of the syllabus comprised under the heads numbered 1, 2, and 3, or 1, 2, and 4 respectively, and the students will be expected to possess a fair elementary knowledge of the subject.

Second Stage or Advanced Course.

In the second or advanced paper the questions will bear upon those portions of the syllabus numbered 1, 2, 3, and 5, or 1, 2, 4, and 5 respectively, and a more exact knowledge of details will be expected.

Examination for Honours.

The range of subjects will be the same as in the advanced course, but the questions will extend over that portion comprised under the sixth head of the syllabus.

1. *Introductory Matter.*—The expansion of bodies by heat, the liquid and gaseous states of matter, the co-efficient of expansion, energy of the atomic forces, practical illustrations of the expansion and contraction of various substances; the tempera-

ture of bodies, instruments for measuring temperature, the thermometer, comparison of thermometers when differently graduated, pyrometers; the capacity of bodies for heat, the calorimeter; the conversion of work into heat and of heat into work, the consumption of heat in liquefaction and vaporization; the convection of heat, the method in which a large mass of water may become heated; the conduction of heat, good and bad conductors, experimental illustrations; the formation of vapour and steam, the boiling points of fresh and salt water, the causes which influence the boiling temperature of water, high-pressure steam, measure of steam pressure by atmospheres, steam when in contact or not in contact with water, the relation between the pressure, density and temperature of steam, the specific gravity of steam, the latent heat of steam, the quantity of water required to produce condensation, common and superheated steam, the analysis of sea water.

The radiation of heat, the absorption of heat, the general relation between radiation and absorption, good and bad radiators of heat, experimental illustrations.

The oxidation of metals, the effects of galvanic action.

2. *Steam Engine.*—Newcomen's atmospheric pumping engine, its defects; the discoveries of Watt, the separate condenser, the expansive working of steam, its economy, its value in regulating the power of an engine.

Details connected with Watt's single-acting pumping engine; the steam cylinder, the valves connected with it, their action, the condenser, the air-pump, the foot valve, the delivery valve, the snifting valve, the hot well, the piston rod, stuffing boxes and glands, the parallel motion; the method of starting the engine, and of regulating its speed, the cataract.

The double-acting condensing beam engine, the principle upon which it works; details of the various parts, the cylinder, how constructed, the ports or openings into the cylinder, the forms of slide valve in common use, the locomotive or three-ported valve, the lap on a valve, the eccentric, the lead of a valve, cushioning the steam, clearance, details of the piston, metallic packing-rings; the expansion valve, and the gear connected with it; the air-pump, condenser, the supply of water for condensation, blowing through, gauges for the condenser, the barometer gauge, method of estimating pressure by it, errors in this method, and correction of the same; the connecting rod, the strap gib and cutter, the parallel motion, the governor, the fly-wheel.

The principle of an equilibrium valve, the double beat valve, the crown valve, the throttle valve, the gridiron valve.

The high-pressure engine without condensation, the expansive principle as applied in the double cylinder condensing engine.

The forms of boiler in common use: the Cornish boiler, the cylindrical boiler with internal flues, the vertical boiler, heating and fire-grate surfaces, the evaporative power of boilers, boiler chimneys; the strength of boilers, the use of stays, the proving of boilers. Boiler appendages; safety valves, reverse or atmospheric valves, communication or stop valves, the glass water gauge, steam pressure gauge, various forms, Bourdon's gauge, feed pumps.

3. *The Locomotive Engine.*—The general construction of a locomotive engine and boiler before the invention of Stephenson, the Killingworth engine; description of the Rocket engine by R. Stephenson as the type of the modern locomotive, the tubular boiler, the draught produced by the discharge of waste steam.

The arrangement of an engine, the cylinders, their position, steamways, ports, slide valve, water cocks, grease cocks, the

piston and packing-rings, piston-rod, guides, connecting rod, eccentrics, the reversing or link motion, reversing lever, sector, expansive working, crank axle and driving wheels, power required for traction, adhesion of the driving wheels, counter weights to cranks, wheels and axles, axle-boxes, bearing springs, buffer and draw springs, friction brakes.

Details of the boiler; the fire-box, the inner and outer shell, ribs on the crown of the fire-box, the cylindrical barrel, the tubes, mode of fixing them, through tie rods, the ashpit, the smoke box, the blast pipe, mechanical action of the blast, the steam chest, the outer dome, the steam pipe, the regulator, safety valves, pressure gauges, whistles, blow-off cocks, feed pumps, Giffard's injector; evaporative power of the boiler, fire-grate and heating surface, combustion of fuel; the tender, water-tank, brake, feed pipes.

The permanent way; varieties of rails in common use, timber sleepers, transverse and longitudinal systems; jointing of rails, the fish joint; the tyres of wheels, their form, general description of switches and crossings.

4. *The Marine Steam Engine.*—Side lever engine, the oscillating engine for paddle-wheel steamers, the vertical trunk engine; the Gorgon engines, the object of this arrangement; other forms of engine. Engines for screw propellors, direct acting engines with or without multiplying gear, Penn's trunk engine, Maudslay and Field's return connecting-rod engine.

Details of parts connected with the working of a marine engine; the air pump bucket and valves, double-acting air pump, India-rubber disc valves, cylinder escape valves, bilge and feed pumps, expansion valves, expansion cams and gear. The method of reversing an engine when fitted with a single eccentric, reversing by a double eccentric, the link motion. Paddle wheels, feathering of the floats, disconnexion and immersion of wheels. The screw propeller, various forms, length, angle, pitch, and area of screw blade, disconnecting and raising the screw, the position of the screw propeller in the vessel, the slip of the screw, the method of receiving the thrust upon the vessel, soft metal bearings.

The marine tubular boiler, how constructed, gun-boat boilers, the steam-chest, fire-bridge and ashpit, the funnel and its casing, waste-steam pipe, water gauge, gauge cocks, pressure gauges, safety valves, reverse valves, stop valves, feed pumps, boiler hand-pumps, feed or donkey-engine, Kington's valves, blow-out cocks, brine pumps and brine-valves, the methods of ascertaining the degree of saltness of the water in a boiler, amount of saltness permissible, formation of scale, superheating apparatus, surface condensation.

Practical working; getting up the steam, filling the boilers, laying the fires, attention to various parts of the engine while the steam is getting up, mode of starting, working the engines at moorings. Priming; its causes and remedies. Duties to machinery when under steam, boilers, fires, &c. Injection pipes. Kingston's valves. Leaks in engines. Bearings of engines. Expansive working. Management of fuel. Damages and repairs to boiler, &c., after accidents. Duties to engine, &c., on arriving in harbour.

5. *Calculations.*—Methods of measuring the efficiency of steam engines. The duty of an engine. The horse power. Mercantile or nominal horse power.

The indicator; the ends it fulfils, description of the instrument, the atmospheric line. Method of taking a diagram. The general configuration of diagram to be expected under various circumstances. Examination of the indicator-diagram when the steam is throttled; when expansive gear alone used, and in other cases. To

ascertain the horse-power of an engine by means of the indicator. The indicator-diagram in a high pressure or locomotive engine.

The principle of the parallel motion of a beam engine.

6. *Calculations.*—Investigation of the work done by the evaporation of water. Estimation of the work done in one stroke of the piston, the same taking clearance into account. To find the horse power from the evaporation in the boiler. De Pambour's theory. Velocity of maximum useful effect. To find the evaporation of a condensing engine of given dimensions and horse power, the piston moving with a given velocity with and without expansion. To find the pressure in the cylinder, knowing the effective evaporation. To find the diameter of a cylinder to work at a certain speed, knowing the evaporation. To find the evaporation in the boiler, knowing the diameter and velocity of the piston and the pressure of steam in the cylinder with and without expansion. The same for locomotive, Watt's engines, &c.

The screw—to find its area, to find also the angle of the helix or thread of the screw propeller, and the pitch. The power exerted by a screw. How far the slip depends on the form and dimensions of the screw. Motion of the paddle-wheels, &c. Consumption of fuel. Measure of the locomotive performance of marine steam engines. To find the angle the crank has moved through when the piston is at a given distance from the top of the stroke. Amount of work developed by the crank in a half-revolution. Length of the radius-bar in a side lever engine. Work done in the up and down stroke of the air pump. The best temperature for the condenser of a steam engine. Qualities of fuel, &c.

Diagram showing the relative motions of the slide and piston at every point of the stroke.

Dynamometer: to find horse-power of engine by means of it.

Text Books.

The text books specially recommended are—

Treatise on the Marine Steam Engine, by T. J. Main and T. Brown, 8vo., 12*s.* 6*d.* (London, Longman, 5th ed., 1865.)

On the Indicator and Dynamometer, by T. J. Main and T. Brown, 8vo., 4*s.* 6*d.* (London, Longman, 1857.)

Catechism of the Steam Engine, by J. Bourne, 12mo., 6*s.* (London, Longman, 1868.)

Manual of the Steam Engine, by the Rev. J. A. Galbraith.

And for reference—

Railway Locomotives, by D. K. Clark, 2 vols., folio, 70*s.* (Edinburgh, Blackie, 1856-60.)

Treatise on the Steam Engine, by J. Bourne, 4to., 42*s.* (London, Longman, 5th ed., 1861.)

Examples of Modern Steam, Air, and Gas Engines, by J. Bourne, Part I., 4to., 2*s.* 6*d.* (London, Longman, 1868.)

SUBJECT XXIII.—PHYSICAL GEOGRAPHY.

First Stage or Elementary Course.

For this stage or course it will be expected that the student shall understand and be able to express the simple facts of the science and explain the terms in common use. The following synopsis will be found to include the various branches of the subject required:—

1. The form and motions of the earth. Its division into land and water. Size and shape of continents. Low lands, their position

and the names by which they are known. High lands or plateaux. Hills. Mountains and mountain systems. Valleys.

2. The ocean and its extent. The names given to different parts. Its depth where known. Its saltness. The movements of the ocean. Marine currents. Waves.
3. Rivers and river systems. Lakes.
4. The air, its nature, extent, and principal uses. Permanent winds. Periodical winds. Storms.
5. Dew. Clouds and rain. Snow and hail. Nature of climate.
6. The nature of earthquakes. The nature of a volcano. Earthquake bands and bands of volcanic action. The simple phenomena of a volcanic eruption.
7. The mode in which plants and animals are distributed on the earth. The mutual relations of horizontal and vertical distribution. The meaning of representative species and the principal groups of plants and animals that represent others in different continents and large islands.
8. The different races of men. The mode in which they are now distributed on the earth.

The examination questions set in this elementary paper will not involve more than a knowledge of such facts as are taught in the ordinary text books.

For a *mere pass* it will only be required that the answers should be so far correct and definite as to show that reasonable care has been taken in explaining the subject, assuming ordinary intelligence and exertion on the part of a young pupil. For a *first class* in this stage sound elementary knowledge and clearness of definition will be indispensable.

Second Stage or Advanced Course.

The more advanced students, who come up in the second stage, will not pass without exhibiting something more than mere elementary knowledge. They must have a knowledge of principles as well as facts. They will be expected to have acquired—

a. So much elementary astronomy as relates to the position of the earth in the solar system, its magnitude and rotation, and the influence of the sun, moon, and other bodies distributed through space on terrestrial phenomena.

b. So much of elementary physics and inorganic chemistry as includes the nature and mode of action of the physical forces and the composition of rocks.

c. So much of elementary geology and mineralogy as includes a knowledge of the nature of rocks, their superposition, succession, and disturbances.

d. So much of palæontology as includes a knowledge of the distribution of life in time.

The bearing of these departments of knowledge on physical geography commonly so called should be understood. The terms used in them must be well appreciated and briefly defined when definitions are asked.

The following more complete synopsis of physical geography will show the nature of an advanced course of instruction.

1. Land. Relation of continents and islands. Protuberance of land and preponderance of land in one hemisphere. Form of extremities of land. Grouping of islands. The geographical axes of the two continents. Influence of the form of a coast line. Characteristic features of the various great masses of land.
2. Mountain axes and mountain systems. Details of the great mountain systems of the world, especially with regard to the continents.

Relations of the different parts of the great mountain system of Europe and Asia. Isolated mountains and mountain system of Africa. Mountain system of America. Culminating points. Knots in mountain chains.

3. High plains or plateaux; their nature and position. Their relations with the geographical axes and to geological structure. Examples of plateaux. Plateaux in small islands. Sierras or mountain ridges rising from plateaux. The drainage of plateaux by deep narrow valleys.
4. Low plains; their distribution and relation to high plains and mountains. The low plains of the principal natural divisions of the world. The steppes of Asia. Deserts of Africa and Arabia. Savannahs and prairies of North America. Silvas, Llanos, Pampas of South America. The characteristics of each. Valleys; their varieties and peculiarities. Difference between mountain valleys and the valleys of plateaux.
5. Water; its position on the earth. Natural divisions caused by the protuberance of parts of the earth. Oceans and inland seas. Depth of the ocean, and means of ascertaining its depth. Nature of the ocean floor. Form of the bottom of the ocean. Solid contents of water. Density of water under different circumstances. Effect of cold on water. Temperature of the sea. Colour of water.
6. Motion of water. Waves. The tidal wave. Currents. The principal stream currents. Drift currents. Irregular movements of water. Sargasso seas.
7. Circulation of water by rivers. Drainage areas and river basins. Nature of water sheds. Origin of rivers. Floods and flood moderators. River systems of the world. Rivers draining into the ocean. Rivers draining into lakes. Groups of lakes; their extent and peculiarities. Waterfalls and rapids.
8. Circulation of water in the interior of the earth. Course of rain water through rock. Issue of this water in springs. Temperature of springs. Mineral and gaseous contents of springs. Quantity of water issuing from springs, and of solid matter deposited by them. Variation of springs.
9. Conveyance of water by clouds, and its deposit as rain. Distribution of rain. Proportion of rainfall that runs over the earth's surface. Formation of snow. Circumstances under which it is formed and deposited. Snow line; its position in different parts of the world. Passage of snow into ice. Glaciers; their ancient and modern history. Glacial action; its nature and results. Icebergs—how and where formed; their influence. Hail; its formation and effects.
10. The atmosphere. Composition and properties of air. Its uses and effects on light. Its extent. Its colour. Effect of heat on the atmosphere. Waves of sound. Nature of wind. Permanent winds. Periodical winds. Circulation of the air by upper currents from the equator to the poles, and corresponding return currents from the poles to the equator. Distribution of winds in both hemispheres. Special local winds and their cause. Various kinds of storm winds. Nature of cyclonic storms. Phenomena connected with such storms.
11. Phenomena of weather and climate. Causes that produce or modify climate. Lines connecting places having equal annual, equal summer, or equal winter heat. Value of such lines as indicating climate. Conditions that affect weather and climate. Cycles of weather and climate. Changes of climate, and the cause of such changes.
12. Volcanic phenomena. General action of volcanoes. The conditions of a volcanic eruption. The parts of the world that contain volcanoes. Number of volcanoes in the different groups; their position and

history of the eruptions. Inactive or extinct volcanoes. Pseudo-volcanoes and phenomena connected with decaying volcanic activity. Geysers, solfataras, and mud volcanoes. Volcanic action under the sea. Periods and cycles of volcanic disturbance. Earthquakes. Zones of earthquake disturbance. Relation of earthquakes to volcanoes. Periodicity of earthquakes.

13. Distribution of life on the earth. Persistence of life. Origin of species. Modification of species. Grouping of plants. Representative and typical species. Advance of certain forms of plant life. Migration and migratory powers of plants. Floras of different countries. Distribution of floras. Faunas, their distribution. Groups of characteristic animals. Migration and migratory instincts. Limitation of these instincts. Distribution of plants and animals in time. Extinction and replacement of species.

14. Distribution of man. Date of introduction of the human family. Early existence of certain typical groups. Mode in which these groups differ anatomically among each other. Mixed races. Migrating and settled races, and their mutual influence. Natural and artificial limits of extension of the various races. Influence of man on external nature.

Sound knowledge of the main facts and an acquaintance with the mode of action of natural causes to produce results will be expected from the more advanced students.

Examination for Honours.

For this examination it will be expected that the candidates shall not only be familiar with the ordinary facts and inferences, but that they should be able to give a tolerably complete outline in their own language of groups of facts and their mutual bearing, together with explanations of natural phenomena on which the principles of physical geography depend.

Sound knowledge acquired, not only from text books, but from a thoughtful examination of the views of various authors or from a personal study of the facts and phenomena will be expected from those who seek an honour certificate, and very clear and definite information on the subjects attempted will be indispensable.

For instruction in physical geography there are several recognised text books. It unfortunately happens that in some of the text books in use in science schools, important facts are incorrectly stated, and teachers employing them must be careful to make the requisite alterations in their course of teaching.

The following books are recommended :—

(1.) For elementary instruction in science classes.

The World we Live in, or First Lessons in Physical Geography, by Prof. D. T. Ansted, 12mo., 2*s*.
(London, Allen & Co., new ed., 1869.)

Outlines of Physical Geography, by E. Hughes, 12mo., 3*s*. 6*d*.
(London, Longmans, new ed., 1866.)

Text Book of Physical Geography, by Dr. Page, 12mo., 2*s*.
(Edinburgh, Blackwood, 1863.)

Physical Geography for Schools, by M. F. Maury, 12mo., 2*s*. 6*d*.
(London, Longmans, 1864.)

(2.) For advanced instruction :—

Physical Geography, by Prof. D. T. Ansted, small 8vo., with maps, 8*s*.
(London, Allen & Co., new ed., 1870.)

Physical Geography, by Mrs. Somerville, new edition, revised by H. W. Bates, Sec. R. Geogr. Soc. (London, Murray, 1870.)
Physical Geography, by Sir John Herschel.
Two Thousand Examination Questions in Physical Geography, by Prof. D. T. Ansted, 12mo., 2*s*. (London, Allen, 1870.)

(3.) For general reference:—

Physical Geography of the Sea, by M. F. Maury, 8vo., 5*s*. (London, Sampson, Low, & Co., 12th ed., 1866.)
Rain and Rivers, by Col. George Greenwood, 8vo. (London, Longmans, 2nd ed., 1866.)
Man and Nature, by George P. Marsh, 8vo. (London, Sampson, Low, & Co., 1864.)
Prickard's Natural History of Man, 8vo. (London, Baillière, 1848.)
Principles of Geology, by Sir C. Lyell, 2 vols., 8vo., 32*s*. (London, Murray, 10th ed., 1868.)
Physical Geography and Geology of Great Britain, by A. C. Ramsay, 8vo., 5*s*. (London, 2nd ed., 1864.)
Principles of Seismology, by R. Mallet, 2 vols., 8vo., 63*s*. (London, Chapman & Hall, 1862.)
Cosmos, by A. von Humboldt, translated by Mrs. (now Lady) Sabine, 3 vols., 12mo. (London, Longmans.)
Aspects of Nature, by A. von Humboldt, translated by Mrs. (now Lady) Sabine, 2 vols., 12mo. (London, Longmans.)
Asie Centrale. Recherches sur les chaînes des montagnes et la Climatologie comparée, 3 vols., 8vo. (Paris, 1843.)
Distribution of Heat over the Surface of the Globe, illustrated by Curves of Temperature, by H. W. Dove, 4to. (London, 1853.)
The Law of Storms, considered in connexion with the ordinary movements of the Atmosphere, by H. W. Dove, translated by R. H. Scott, 8vo. (London, 1863.)
Géographie Botanique raisonnée, ou exposition des faits principaux et des lois concernant la distribution géographique des plantes de l'époque actuelle, par J. de Candolle, 2 vols., 8vo. (Paris, 1855.)
An Account of the great Floods of August 1829 *in the Province of Moray and adjoining Districts*, by Sir Thomas Dick Lauder, Bart., 8vo. (Edinburgh, Black.)
An Attempt to develope the Law of Storms, by Lieut.-Colonel W. Reid, C.B., R.E. (London, Weale, 1838.)

In addition to the above, many other works in special departments of the science will be found useful to the advanced student and to the candidate in honours. The following are examples:—

Physical Geography of the Sea, by M. F. Maury, 8vo., 5*s*. (London, Low, 12th ed., 1866.)
Man and Nature, by G. P. Marsh, 8vo., 14*s*. (London, Low, 1864.)
Principles of Geology, by Sir C. Lyell, 2 vols. 8vo. (London, Murray, 1866.)
Principles of Seismology, by R. Mallet, 2 vols. 8vo., 63*s*. (London, Chapman and Hall, 1862.)

It is most desirable that Physical Geography should be taught and studied with good physical maps at hand. For the elementary course is recommended—

Small Atlas, by Hughes.

For the advanced student:—

Physical School Atlas, by Johnston.
Larger Physical Atlas, by Johnston.

APPENDIX C.

TABLES showing the NUMBER of STUDENTS in each SCIENCE SCHOOL or CLASS, and the SUBJECTS taught.

TABLE I.

LIST of SCIENCE SCHOOLS in existence on the 1st March 1870, giving the NUMBER of STUDENTS returned as under INSTRUCTION in MAY 1868 and MAY 1869, and the NUMBER of PRIZES and MEDALS obtained in MAY 1868 and MAY 1869.

Schools established since May 1869 are printed in italics.

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
				ENGLAND.									
Abingdon	Brit. Sch.	Harper, Rev. E. T. H.	Davis, J. G.	Gubb, E. J.; Gubb, A.; Butler, E.; Payne, F. W.	46	62	16	..	14	1	..	..	2s. 6d. ea. subject.
Accrington	Mech. Inst.	Hargreaves, B.	Ratcliffe, W.	Brown, T.; Edwards, S.	29	39	10	..	18	5	..	..	2s. 6d.
Accrington	*Christ Ch. Nat. Sch.*	*Hargreaves, B.*	*Ratcliffe, W.*	*Bogle, J.*	..	..	..	..	..	..	..	..	2s.
"	*25, Bridge St.*	"	"	*Elloft, T.*	..	..	..	..	..	..	..	..	3s.
Alderley Edge (Manchester)	Reading Room	Consterdine, Rev. J. W.	Railton, G. W.	Dale, J.; Dawson, C. J.	18	16	..	2	6	1	..	..	2s. per qr.
Almondbury (Huddersfield)	Gram. Sch.	Hulbert, Rev. C. A.	Dyson, E.	Easther, Rev. A.; Jarmain, G	26	25	..	1	2	..	..	..	12l. 10s. per annum.
Alnwick	Mech. Inst.	Trotter, Rev. E. B.	Robertson, A.	Muxlow, T.	28	38	10	..	..	1	..	..	2s. 6d.
Andover	Gram. Sch.	Clarke, T. P.	Footner, R.	Marriott, J. T.	39	31	..	8	6	..	..	..	2s. 6d.
Armley (Leeds)	*Nat. Sch.*	*Smith, Rev. F. G.*	*Goodall, Rev. W.*	*Brears, W.*	..	..	..	..	..	..	..	..	Nil.
Ashby-de-la-Zouch	Mut. Imp. Soc.	Green, Rev. T. S.	Dalby, J.	Gibson, G. H.	19	27	8	..	8	..	..	..	2s. 6d. to 5s.
Ashton-under-Lyne	Mech. Inst.	Mason, H.	Andrew, J.	Jones, T.	29	25	..	4	12	1	..	..	1s. per qr. each subj.
" "	Hurst Mech. Inst.	Whittaker, R.	Pleasants, J.	Stott, H., sen.	..	12	12	..	..	4	..	..	2s.
Ashton-under-Lyne	*St. Michael's Y. Men's Class*	*Moss, J.*	*Buckley, E.*	*Booth, I.; Cooke, J. B.*	..	..	..	..	..	..	..	..	1s. each subject.
" "	*Dukinfield Village Library and Old Chapel Schs.*	*Marshall, W.*	*Broadrick, E. B.*	*Robinson, E.; Jones, T.*	..	..	..	..	..	..	..	..	2s. to 3s.
Backworth (Northumberland)	*Old Chapel*	*Richardson, H.*	*Hunter, J.*	*Rowden, W. T.; Kernick, R.; McDougall, T.*	..	..	..	..	..	..	..	..	5s.
Bacup	Mech. Inst.	Aitken, J.	Hargreaves, J. H.	Shore, T. W.; Sutcliffe, G. W.	42	35	..	7	27	..	..	1 B.	2s. to 2s. 6d.

,, (Lanc.)	Wos. Day Sch.	Carr, Rev. J.	Lord, W. H.	Holland, J.	..	10	10	..	..	7	..	..	1s. 6d. per quarter.
Balham	Wkg. Men's Inst.	Largo, Rev. W. A. A.	Loat, J. H.	Jones, T. Brittle, J. R.	..	18	18	..	..	..	..	..	6s.
Banbury	Brit. Sch.	Grimbly, J.	Hewett, G. A.	Beale, J. H. Owen, A.	48	47	..	1	8	..	1 B.	..	2s. 6d. to 5s.
,,	Mech. Inst.	Cobb, T. R.	Wilson, A.	French, A.	..	13	13	..	..	1	..	..	2s. 6d. & 5s.
Bangor	*Normal College*	*Hughes, W. B., M.P.*	*Jones, G.*	*Thomas, J.*	..	..	..	..	..	..	..	..	Nil.
Banstead (Surrey)	Nat. Sch.	Glyn, Hon. P. C.	Buckle, Rev. E. V.	Knibbs, H.	..	33	33	..	..	1	..	..	2s. per subject.
Barnard Castle	Mech. Inst.	Brown, Rev. F.	Monkhouse, J.	Witter, J. A. Bailey, G. H.	..	10	10	..	..	..	..	..	2s. per mo. each subj.
Barnsley	,,	Allen, T.	Gration, J.	Brears, W.	18	17	..	1	1	1	..	..	2s. 6d.
Barnstaple	Lit. and Sci. Inst.	Guppy, T. W. M. A.	Mackrell, T.	Dunston, J. J. Maunder, S. G.	..	73	73	..	..	..	..	..	5s. 6d. ea. subject.
Bath	*St. Mark's Nat. Sch.*	*Sproule, Rev. J. W.*	*Shaw, Rev. W. S.*	*Nevill, M.*	..	..	..	..	..	..	..	..	2d. per wk.
,,	*Weston Boys' Sch.*	*Bond, Rev. J.*	*Stedman, Rev. J.*	*Knight, J.*	..	..	..	..	..	..	..	..	2s.
Batley	Mech. Inst.	Jubb, J.	Hick, W. H.	Osborne, J. Brears, W.	..	8	8	..	..	1	..	..	5s.
Batley	*Indepent. Sch.*	*Rae, Rev. J.*	*Ellerby, R.*	*Brears, W.*	..	..	..	..	..	..	..	..	Nil.
Beccles (Suffolk).	Science Sch.	Crowfoot, W. M. E.	Mayhew, J.	Boyce, H.	..	27	27	..	..	..	..	..	5s.
Bedford	Commercial Sch.	Gray, T. T.	Fry, P. S.	Glover, A. W.	..	21	21	..	..	3	..	..	2s. 6d. to 15s. each subject.
Bedlington	*Colliery Sch.*	*Whitley, Rev. C. T.*	*Fisher, W.*	*Rowden, W. T.* *Kernick, R.* *Wallace, J.*	..	..	..	..	..	..	..	..	5s.
Berkeley (Glos.)	*Ch. of Eng. Sch.*	*Turton, Rev. H. M.*	*Phillips, J. G.*	*Hodgson, J. J.*	..	..	..	..	..	..	..	..	2s. 6d.
Bingley (Leeds)	Mech. Inst.	Irwine, Rev. A. P.	Holgate, R.	Severs, G.	17	19	2	..	3	1	..	..	Nil.
Birkenhead ,,	Laird St. Hamilton St.	Taylor, J.	Hinde, W. E.	Bentley, J. Nicol, J. C.	..	30	30	..	..	3	..	..	6s. to 10s. 6d.
Birmingham	B. and Mid. Inst.	Kenrick, W.	Smith, E.	Woodward, C. J. Hinds, W. Hinds, J. Bulpitt, W. T. Causer, W. G.	152	230	78	..	49	22	1 B.	..	1d. a night to 14s. per term.
,,	Sch. of Art	Cope, C. R.	Laundy, E.	Raimbach, D. W. Causer, W. G.	75	77	2	..	38	13	1 B.	..	65l. 3s. 6d. total amt.
,,	Bloomsbury Inst.	Milward, Rev. H. C.	Aston, J.	Smith, D. Smith, A. F. Walton, W.	80	104	24	..	26	8	..	..	2s. to 9s.
,,	Clarendon Chambs.	Manton, H.	Southall, A.	Smith, D. Turner, J. Davis, J.	11	30	19	..	8	4	..	..	2s. to 3s.
,,	Deritend W. M. Assoc.	Solomon, H.	Greening, W. H.	Bagley, T. Roberts, A. Bridge, T. W.	..	23	23	..	..	..	..	..	Nil.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
Birmingham -	Graham St. Inst. -	Vince, Rev. C. - -	Player, J. - -	Lancaster, W. J. - Jennings, J. M. -	..	24	24	..	..	2	..	..	1s. 6d.
" -	Bishop Ryder's Sch.	Yorke, Hon. and Rev. G. M.	Burges, Rev. J. H.	Paterson, C. - Thorneloe, T. - Shirley, J. - -	..	40	40	..	..	..	..	..	4d. per wk.
" -	Middle Class Sch. -	Rolason, W. - -	Payton, H. -	Causer, W. G. - Smith, G. - -	..	19	19	..	..	2	..	..	Nil.
" -	Ch. of the Sav. Sch.	Myers, Rev. E. -	Hemming, W. H.	Embrey, G. - -	..	20	20	..	..	..	..	..	1s. per qr. each subj.
" -	St. George's - -	Thornton, Rev. S. -	Smith, G. - -	Bulpitt, W. T.- -	..	58	58	..	..	6	..	1 S.	1s.
" -	New Jerusm. Sch. -	Tonks, S. - - -	Osborne, J. -	Jones, G. F. - -	..	7	7	..	..	..	..	..	Nil.
" -	St. Mark's Sch. -	Thwaites, Rev. H. G.	White, W. -	Buckley, H. C. - Robins, H. St. J. -	..	59	59	..	..	..	..	..	1s. 6d. ea. subject.
" -	St. Mary's, Bath St.	Barrett, Rev. J. C. -	Edwards, J. R. -	Bulpitt, W. T. - Betton, A. - -	..	16	16	..	..	..	..	..	1s.
" -	St. Clement's Sch. -	Milward, Rev. H. C.	Eden, W. - -	Bulpitt, W. T. - Hayfield, W. -	..	20	20	..	..	5	..	..	1s.
" -	St. Paul's Sch. -	Burgess, Rev. R. B.	Langford, J. A.	Embrey, G. - - Bulpitt, W. T. - Betton, A. - - Roberts, T. - -	..	66	66	..	..	..	..	..	Nil.
Birmingham -	*Steel House Lane Sch.*	*Manton, H.* - -	*Manton, H., jun.*	*Walton, W.* - -	..	..	..	..	..	..	..	..	6d. per qr.
" -	*St. Matthias Sch.* -	*Bray, Rev. H. T.* -	*Jacombs, W. H.*	*Bulpitt, W. T.* -	..	..	..	..	..	..	..	..	1s.
" -	*Blue Coat Sch.* -	*Pettitt, Rev. G.* -	*Price, H.* -	*Dunn, G. S.* - -	..	..	..	..	..	..	..	..	Nil.
" -	*Mut. Imp. Soc.* -	*Hinks, J.* - - -	*Langford, J. A.*	*Embrey, G.* - *Roberts, T.* - -	..	..	..	..	..	..	..	..	Nil.
" -	*Wes. Sch., Hatchett St.* -	*Hearnshaw, Rev. J.*	*Bloxham, J.* -	*Pillor, W. T.* - -	..	..	..	..	..	..	..	..	1s. 6d. per session.
" -	*Friends' Bible Assoc. Rooms* -	*Sturge, C.* - -	*Southall, A.* -	*Turner, J.* - -	..	..	..	..	..	..	..	..	1s.
" -	*Trade Sch., Rocky Lane* - -	*Manton, H.* - -	*Austin, W.* -	*Walton, W.* - -	..	..	..	..	..	..	..	..	1s. 6d. per term.
Birstall (Leeds)	Mech. Inst. - -	Heald, Rev. W. M. -	Priestley, J. W.	Patchott, I. - -	20	53	27	..	22	3	..	..	1s. 6d. ea. subject.
Bishop Auckland. -	*Wes. Sch.* - -	*Chambers, Rev. W.*	*Hepton, Rev. T.*	*Marshall, H.* - -	..	..	..	..	..	..	..	..	2s. 6d. to 5s.
Bishop Stortford.	*Lit. Inst.* - -	*Starling, G. A.* -	*Blunt, Rev. A. H.*	*Morgan, J. H.* -	..	..	..	..	..	..	..	..	6s. to 7s.

Blackburn	Wes. Sch.	Woodhouse, Rev. C. W.	Parkinson, G.	Isherwood, T.	9	35	26	..		8	..	..	2s. 6d.
"	Ch. Inst.	" "	Elwell, Rev. H.	Sayle, J.	..	6	6	..	..	..	..	..	2s. 6d. ea. subject.
Blackburn	*Town Hall*	*Woodhouse, Rev. C. W.*	*Parkinson, G.*	*Hurst, W.*	..	..	..	..	..	..	..	..	2s. ea. sub.
Blackley (Manchester).	Assembly-room	Langton, W.	Schofield, J.	Hurst, W.	..	31	31	..	..	2	..	..	Tot. amt. 72s.
Blyth (Northumberland).	Nat. Sch.	Greenwell, Rev. W.	Rees, W.	Rowden, W. T.; Kernick, R.; Wallace, J.	..	46	46	..	..	6	..	..	5s.
Bodmin	Lit. Inst.	Stokes, H. S.	Phillipps, J.	Downing, S.	31	69	38	..	16	1	..	..	1s. to 3s. 6d.
Bolton	Sci. and Art Sch.	Powell, Rev. H.	Doman, Rev. J. G.	Collins, J.; Spriggs, C.	193	161	..	32	37	5	..	..	1s. to 2s. each sub.
"	Mech. Inst.	Barlow, J.	Dakeyne, J.	Spriggs, C.; Goulding, E.	67	64	..	3	16	4	1 B	..	1s. 6d. per quarter.
"	Dean Mills B. Sch.	Callender, W. R.	Maycock, W.	Spriggs, C.	..	20	20	..	..	1	..	..	3s.
Bolton	*Unitarian Day Sch.*	*Harwood, J.*	*Rigby, T.*	*Andrews, H.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Boston	Sci. and Art Sch.	Blenkin, Rev. G. B.	Lowe, Rev. G. W.	Howard, V.; Gane, W.	.. ..	18 25	18 25	.. ..	.. ..	4	..	..	1s. and 2s. per mo. each sub.
"	Nat. Sch.	" "	" "	Gandy, J.	..	..	..	..	..	..	..	..	1s. to 2s.
Bow	Schoolroom, Old Ford Road	Schnadhorst, E.	Smith, E.	Saunders, J.; Duff, C.	..	20	20	..	..	6	..	..	6s.
Bradford	Mech. Inst.	Law, J.	Holbrey, J.	Severs, G.	..	10	10	..	..	3	..	..	1s. to mem.
Bradford	*Schoolmasters' Cl.*	*West, E.*	*Miall, L. C.*	*Jarmain, G.*	..	..	..	..	..	..	..	..	10s. 6d.
"	*Wes. Sch.*	*Walker, Rev. S.*	*Ives, J.*	*Sugden, W.*	..	..	..	..	..	..	..	..	4s. 6d.
"	*Hallfield Sch.*	*Hick, J.*	*Claxton, E. A.*	*Watson, M.; Monckman, J.*	..	..	..	..	..	..	..	..	2s. per qr.
Bramley (Leeds)	*Grove House*	*Golt, Rev. J.*	*Seppings, Rev. D. W.*	*Ramsay, E. J.; Cope, Rev. S. W.*	..	..	..	..	..	..	..	..	5s.
Breage (Cornwall).	Institution	Pridmore, Rev. E. M.	Argall, W.	Kitto, B.; Eudey, J.	23	52	29	..	17	2	2 B.	..	2s. 6d. to 5s.
" "	Germoe, N. S.	"	"										
Bredbury (Stockport)	*St. Mark's N. S.*	*Vandry, W. C.*	*Hartley, T.*	*Lea, J.*	..	..	..	..	..	..	..	..	2s. 6d.
Bridport	*Lit. and Sci. Inst.*	*Montagu, J. P.*	*Chowne, Rev. J. H.*	*Campbell, J. A. D.*	..	..	..	..	..	..	..	..	10s. to 20s. per ann.
Brigstock (Northants).	Farming Woods Sch.	Attenborough, J.	Bradshaw, W. P.	Garner, S.	..	53	53	..	..	2	..	..	2s. 6d. ea. subject.
Brington (Northamp.)	*Nat. Sch.*	*Wykes, J.*	*Ponsonby, Rev. F. J.*	*Seal, C.*	..	..	..	..	..	..	..	..	1d. per wk.
Bristol	Trade Sch.	Moseley, Rev. Canon	Wilkson, J.	Coomber, T.; Plant, E. C.; Welsh, J.; Richards, W.; Morgans, W.; Leipner, A.	145	200	55	..	106	94	1 G., 1 B.	1 G. 1 S. 2 B.	3s. to 15s. per qr.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
Bristol	Young Men's Christ. Assoc.	Cornall, Rev. R.	Williams, W. H.	Ewens, F. T.	..	17	17	..	..	4	..	..	2s. 6d. and 10s. 6d.
Bristol	*North St. Wes. Sch.*	*Clapham, Rev. J.*	*Budgett, W. H.*	*Mawbey, H.*	..	..	..	..	..	..	..	..	2s. 6d.
Brixham (Devon).	*Brit. Sch.*	*Lakeman, T.*	*Putt, R.*	*Trotter, G. O.*	..	..	..	..	..	..	..	..	2s.
Bromsgrove	Lit. and Mech. Inst.	Murray, Rev. G. W.	Gibson, G. W.	Dodd, W.	26	66	40	..	7	..	..	..	2s. 6d.
Burnley	Lit. Inst.	Parker, Rev. A. T.	Briggs, B. W.	Shore, T. W.; Pickup, W.; Bell, T.	58	47	..	11	14	5	..	..	2s. 6d. to 4s. 6d.
"	Mech. Inst.	Shuttleworth, Sir J. P. K.	Sutherland, J.	Shore, T. W.; Thompson, J.	48	77	29	..					2s. 6d. to 3s. 6d.
"	Gram. Sch.	" "	"	Wilkinson, T. T.; Shore, T. W.	40	40	..	..	12	4	..	..	Grm. Sch. 1s. per 12 lessons.
Burnley	*St. Peter's Sch.*	*Shuttleworth, Sir J. P. K.*	*Sutherland, J.*	*Shore, T. W.*	—	..	..	..					
Burnley	Carlton Road Sch.	Harrison, R.	Graham, J.	Grant, J.	61	59	..	2	6	..	..	..	1s. per qr. each sub.
Burslem	*Sch. of Sci. and Art*	*Davenport, H. T.*	*Woodall, W.*	*Theaker, G.*	..	..	..	..	..	..	..	..	2s. per mo. each sub.
Bury (Lanc.).	Athenæum	Wormald, J.	Probert, T. W.	Spriggs, C.	79	77	..	2	25	10	..	..	2s. per qr.
Caistor	Lower Gram. Sch.	Maclean, Rev. H.	Mowbray, Rev. J. H. M. de	Thomas, R.	..	13	13	..	..	..	..	..	2s. 6d. ea. subject.
Calverley (Leeds).	*Mech. Inst.*	*Yewdall, D.*	*Kellett, J. jun.*	*Harrison, J.*	..	..	..	..	..	..	..	..	Nil.
Camborne	Lit. Inst.	Smith, W. B.	Butlin, C. H.	Provis, T. B.; Collins, J. H.	24	12	..	12	5	..	..	..	2s. 6d. to 10s.
Canning Town (Essex)	Holy Trinity Sch.	Dolap, Rev. A. B.	Peacock, W. H.	Shipman, C.; Downar, W. A.	12	34	22	..	5	6	..	..	5s.
Cardiff	Free Library	Taylor, W.	Price, P.	Bush, J.; Bush, W.	63	91	28	..	27	10	..	..	5s. per qr.
Carharrack (Cornwall).	Lit. Inst.	Tucker, J. B.	Green, R.	Collins, J. H.	..	20	20	..	..	..	..	..	Nil.
Carmarthen	*Trg. Coll.*	*Jones, Rev. L. M.*	*Jenkins, Rev. R. R.*	*Morris, Rev. B. H.; Marshall, Rev. F.*	..	..	..	..	..	..	..	..	Not yet fixed.
Charlesworth (Derbyshire).	*Mech. Inst.*	*Shipley, D.*	*Cooper, M.*	*Booth, S.*	..	..	..	..	..	..	..	..	2s.
Charlton, New (Kent).	*Math. Inst. Wks., Woolwich Road.*	*Balgarnie, Rev. R.*	*Scott, W.*	*Hepburn, R.*	..	..	..	..	..	..	..	..	6s.

Chatham	St. Mary's Nat. Sch.	Stephens, Rev. H. B.	Wilkins, T.	Byatt, H. Sanguinetti, P. A. Laskey, J. J.	40	57	17	..	28	6	...	...	7s. 6d.
"	St. Mark's	Neville, H. J. W.	Bridger, J.	Byatt, H. Brazier, C.	37	37	19	..	19	10	..	1 G.	7s. 6d.
Cheltenham " "	Sch. of Sci. Trg. Coll. Brit. Sch.	Skillicorn, W. N.	Phillipps, J. S.	Ewens, F. Brereton, R. W. James, H. A. Bromileau, M.	212	64	..	146	32	5	1 G.	..	2s.
"	Whitworth Sch.	Ford St. C.	Dixon, R. J.	Davis, W. S. Jeffery, W. Davis, T. H.	..	266	266	..	..	14	..	1 B.	2s. 6d. to 10s. 6d. per quarter.
Chester	Sch. of Art	Howson, Very Rev. J. S.	Deacle, Rev. E. L. Y.	Craister, W.	30	45	15	..	8	5	..	..	2s. per mo. 2s. 6d. the course.
Chesterfield	*Nat. Sch.*	*Carrington, T.*	*Booth, G.*	*Francis, E.*	..	..	..	..	..	..	..	..	5s. ea. sub.
Chorley	St. George's Nat. Sch.	Barton, R. H.	Stock, Rev. J.	Brown, T.	20	15	..	5	7	3	..	..	3s.
Church (Accrington)	Nat. Sch.	Birchall, Rev. J.	McKenzie, T. S.	Sutcliffe, G. Boyd, P.	..	57	57	..	..	2	..	..	2s. to 3s. per sess.
Cirencester	*Sch. of Art*	*Millar, Rev. J. O.*	*Zachary, H.*	*Miller, J.*	..	..	..	..	..	..	..	..	10s.
Clay Cross	*Public Hall*	*Binns, C.*	*Halliday, T.*	*Francis, E.*	..	..	..	..	..	..	..	..	5s.
Coalbrookdale	Lit. and Sci. Inst.	Dickinson, H.	Squire, E. L.	Woolner, H.	..	25	25	..	..	..	..	..	4s.
Colne	Gram. Sch.	England, T. T.	Phillips, T.	Bell, T.	..	30	30	..	..	4	..	..	5s.
Compstall (Stockport)	Athenæum	Andrew, G.	Fernley, J.	Parnell, G. Bradshaw, G.	27	28	..	1	20	8	..	..	2l. 14s.
Cottesmore	*Nat. Sch.*	*Stuart, Rev. A. G.*	*Miles, Rev. S.*	*Cattell, T.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Coventry	St. Peter's N. S.	Odell, J.	Tabberer, Rev. G.	Bates, J.	..	30	30	..	..	..	..	..	1s. per qr.
Crawshawbooth	*Mech. Inst.*	*Brooks, T.*	*Taylor, J.*	*Sutcliffe, G. W.*	..	..	..	..	..	..	..	..	2s. 6d. to 5s.
Crewe	Mech. Inst.	Ramsbottom, J.	Jackson, J. A.	Craister, W.	44	31	..	13	20	9	..	..	2s. per mo. or 2s. 6d. the sess.
Croydon	Lit. and Sci. Inst.	Carpenter, A.	Lanchester, H. T.	Childs, T. Jones, T.	32	17	..	15	13	..	..	..	5s.
Croydon	*St. Andrew's N. S.*	*Long, Rev. D.*	*Smith P.*	*Busbridge J.*	..	..	..	..	..	..	..	..	5s.
Culham (Oxfordshire)	Trg. Coll.	Pott, Rev. A.	Causton, Rev. F. J.	Ridgway, Rev. J. Herbert, Rev. A. House, J.	27	28	..	4	3	5	..	..	Nil.
Dartmouth	Nat. Sch.	Newman, A.	Rees, W. H.	Hamlyn, E.	26	39	13	..	6	..	..	..	4s. ea. subj.
Darwen	Mech. Inst.	Blamire, Rev. W. H.	Neville, E.	Hurst, W.	14	9	..	5	3	..	..	..	2s. 6d. ea. subject.
Daventry (Northants).	Gram. Sch.	Collyns, Rev. P. M.	Marriott, T. H.	Rigby, J.	..	16	16	..	..	1	..	..	6d. per mo.
Deptford	St. Paul's Sch.	Lewes, S. S.	Marchant, T. W.	Busbridge, W. Hopper, T. Ellercamp, H. Cleminson, J.	21	85	64	..	27	17	..	..	5s.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
Deptford	*Mission Hall* *St. John's Sch.*	*Money, Rev. O. F. S.*	*Earland, T.*	*Mondy, E. F.* *Farncomb, E.*	..	..	..	..	..	..	..	..	9s.
Derby	Gram. Sch	Evans, T. W.	Goode, H.	Greaves, C. A.	12	10	..	2	..	..	..	..	Nil.
Devonport	Mech. Inst.	Rolston, J.	Chapple, S.	Balkwill, F. P.	..	8	8	..	..	..	..	..	5s.
Devonport	14, *St. Aubyn Street*	*Greaves, Rev. H. A.*	*Cuddeford, T.*	*Evers, H.*	..	..	..	..	..	..	..	..	5s.
Dewsbury	Mech. Inst.	Day, E.	Warburton, J.	Shaw, J. Nettleton, W. Tinker, H.	17	17	..	..	1	1	..	..	2s. 6d. to 5s.
Dewsbury	*Wes. Lit. Soc.*	*Rawsthorne, J. J.*	*Thompson, W. R.*	*Osborne, J.*	..	..	..	..	..	..	..	..	5s.
Doncaster	Guildhall	Pigon, Rev. F. Hatfield, C. W.	Taylor, A.	Constable, J.	..	24	24	..	..	2	..	..	2s. 6d. per quarter.
Doncaster	*G. N. R. Sch.*	*Campion, Rev. J.*	*Kyle, Rev. J.*	*Branston, Z. H.*	..	..	..	..	..	..	..	..	2s. 6d.
Droitwich	*Nat. Sch., Holloway*	*Topham, Rev. J.*	*Lea, Rev. W.*	*Jeacock, J. S.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Droylsden	Educ. Inst.	Hadwen, J.	Hadfield, J.	Hurst, W. Kay, W. Riley, J. Baguley, M.	58	49	..	9	23	13	..	..	2s. each subject.
Dudley	Mech. Inst.	Gibson, Rev. M.	Hollier, E.	Causer, W. G. Marshall, W. W.	..	69	69	..	..	1	..	..	9s. to 10s. ea. subj.
„	Blue-coat Sch.	Wainwright, H. M.	Brettell, T.	Williams, J.	..	50	50	..	..	..	..	..	2d. per week, 10s. to course.
Dudley	*Netherton Sch.*	*Slade, Rev. J. J.*	*Taylor, Rev. G. J.*	*Green, F.*	..	..	..	..	..	..	..	..	2s. ea. subj.
Dunstable	*Ashton Schs.*	*Burges, S.*	*Howell, F.*	*Hatt, F.*	..	..	..	..	..	..	..	..	1s.
Durham	Trg. College	- - - - -	Earle, W. E.	Powley, W. Howard, C. C.	..	..	..	..	..	..	..	..	Nil.
Eagley	Institute	Greg, A.	Marson, G.	Pinnington, W.	31	20	..	11	5	..	..	..	2s. ea. class
Earlestown	Infant Sch.	Whitley, Rev. J.	Shaw, C.	Stott, H. Burchall, C.	17	24	7	..	5	10	..	..	2s. 6d.
Earlestown (Newton-le-Willows)	*L. and N.-W. Ry. Works Library*	*Emmett, J. W.*	*Banton, W.*	*Jones, T.*	..	..	..	..	..	..	..	..	1s. ea. subj.
Eastington (Glos.)	Nat. Sch.	Peters, Rev. T.	Hooper, C. H.	Wilcox, E.	15	16	1	..	3	3	..	..	1s. ea. subj.
Eastwood (Notts.)	Mech. Inst.	Plumptre, Rev. H. W.	Brentnall, A. W.	Fisher, H.	13	9	..	4	6	..	..	..	3s. per qr.

Eccleshill (Leeds).	*Mech. Inst.*	*Mercer, Rev. E.*	*Harland, E.*	*Harrison, J.*	..	..	..	..	..	..	..	..	10*s.*
Elland (Halifax)	Nat. Sch.	Sandford, Rev. E.	Kaye, U.	Akroyd, B. Tattersall, A. Kershaw, T.	28	43	21	..	11	8	..	1 S.	5*s.*
Elsecar (Barnsley).	*Nat. Sch.*	*Hodges, Rev. W.*	*Nayler, J.*	*Washington, M.*	..	..	..	..	..	..	..	..	2*s.* 6*d.*
Erith	Nat. Sch.	Smith, Rev. C. J.	Desbois, D.	Stanton, G. Byatt, H.	..	..	..	..	..	..	..	..	5*s.* per ann.
Evesham	Deacles Sch.	Bentley, Rev. W. de	Burlingham, R.	Sturgess, W.	..	..	..	..	..	..	..	..	Nil.
Exeter	Albert Mem. Mus.	Head, R. T.	Tucker, J. T.	Perkins, F. P. Sheppard, W. Jerman, J.	32	34	2	..	11	4	..	..	5*s.* to 10*s.*
Failsworth (Manchester)	Mech. Inst.	Wright, R.	Brierley, J.	Stott, H. Stott, H. junr.	8	20	12	..	1	10	..	..	2*s.* 6*d.*
Farnworth	Gram. Sch.	Taylor, Rev. W. H.	Smart, Rev. J.	Spriggs, C. Cartwright, G. P.	..	32	32	..	..	2	..	..	Nil.
"	Halshaw Moor	Barnes, A.	Prestwich, R. H.	Monks, P.	..	20	20	..	..	2	..	..	Nil.
Farnworth (Bolton).	*Wes. Sch.*	*Hindley, J.*	*Tetley, Rev. J. D.*	*Faulkner, J.*	..	..	..	..	..	..	..	..	1*s.* per qr.
" "	*St. James' Sch., New Bury*	*Stewart, Rev. C. J.*	*Tong, J.*	*Cooke, S.*	..	..	..	..	..	..	..	..	1*s.* per qr.
Faversham	*Institute*	*Donne, Rev. C. E.*	*Johnston, S. G.*	*Field, W.* *Batterbee, N.*	..	..	..	..	..	..	..	..	Nil.
Finedon (Northants).	*Temperance Hall*	*Dolbein, W. M.*	*Harlock, J.*	*Brooks, W. W.*	..	..	..	..	..	..	..	..	1*s.* 6*d.*
Frampton-on-Severn.	*Nat. Sch.*	*Clifford, H. J.*	*St. John, Rev. F.*	*Smith, P. L.*	..	..	..	..	..	..	..	..	1*s.* 6*d.*
Friezland (Manchester).	Christ Ch. Inst.	Buckley, J. F.	Schofield, G. H.	Kershaw, J.	..	11	11	..	..	..	..	..	5*s.*
Frome	Sch. of Art	Horner, Rev. Preby.	Singer, J. W.	Goepel, J. S.	..	40	40	..	..	..	..	..	2*s.*
Frome	*Blue-coat Sch.*	*Daniel, Rev. A.*	*Daniel, G. A.*	*Brown, W.*	..	..	..	..	..	..	..	..	Nil.
Garforth (Leeds)	*Wkg. Men's Club*	*Whitaker, Rev. G. H.*	*Woodhead, A.*	*Schofield, J.*	..	..	..	..	..	..	..	..	5*s.* and 2*s.* 6*d.* boys
Gateshead	Nat. Sch.	Prest, Ven. Archdea.	Russell, Rev. C. D.	Wheatley, M. J. Brodie, A.	39	101	62	..	13	7	..	..	5*s.* ea. subj.
Gateshead	*Felling Chem. Works*	*Redmayne, J. M.*	*Redmayne, R. R.*	*M'Laren, J.* *Lambton, J. W.*	..	..	..	..	..	..	..	..	5*s.* to 10*s.* 6*d.*
Gee Cross (Hyde).	*Hyde Chapel Sch.*	*Thornely, T.*	*Dowson, Rev. H. E.*	*Taylor, T.*	..	..	..	..	..	..	..	..	1*s.*
Gildersome (Leeds).	*Lit. Inst.*	*Haslam, Rev. J.*	*Richardson, G.*	*Patchett, I.*	..	..	..	..	..	..	..	..	3*s.*
Glossop	*Littlemoor M. I.*	*Atkin, Rev. T.*	*Wood, S.*	*Jones, T.*	..	..	..	..	..	..	..	..	2*s.*
Gloucester	Sci. Sch., 10 Eastgate St.	Washbourn, B.	Fowler, Rev. H.	Jeffery, W. Davis, W. S.	34	19	..	15	..	..	..	..	2*s.* 6*d.* ea. subject.
Gloucester	*Sch. of Art*	*Parry, T. G.*	*Niblett, J. D. T.*	*Kemp, J.*	..	..	..	..	..	..	..	..	6*s.* per qr.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
Gomersal (Leeds)	Mech. Inst.	Crowther, W.	Kellett, J.	Patchett, I.	..	19	19	..	..	..	..	..	3s. 6d. ea. subject.
Gorton	*M. S. and L. R. Y. Society*	*Peacock, R.*	*Greenwood, J.*	*Botheras, R.*	..	..	..	..	..	..	..	..	1d. per night.
Grantham	Nat. Sch.	Ostler, W.	Maddison, Rev. G.	*Hudson, Rev. R.* *Cockman, A.* *Fishenden, R. E.*	..	12	12	..	..	2	..	1 G.	1s. to 2s. per mo.
Gt. Harwood (Blackburn)	*Nat. Sch.*	*Haslewood, Rev. W. M.*	*Exley, W.*	*Loynd, E. B.*	..	..	..	..	..	..	..	..	2s. 6d. per session.
Gt. Horton (Bradford)	*Wes. Sch.*	*Barley, Rev. D.*	*Ritchie, Rev. J.*	*Martin, W. J.*	..	..	..	..	..	..	..	..	Nil.
Greenwich	St. Mary's Girls' N.S.	Miller, Rev. J. C.	Howarth, W.	Wright, H. E.	20	27	7	..	11	3	..	..	5s.
Greenwich	*Mech. Inst., Roy. Hill*	*Purvis, P.*	*Lough-borough, J. G.*	*Jones, T.* *Purnell, W. J.* *Browne, L.*	..	..	..	..	..	..	..	..	2s. 6d. to 5s.
Guildford	*County Hall*	*Upperton, E. T.*	*Campbell, C. D.*	*Goffin, R. E. H.*	..	..	..	..	..	..	..	..	4s. per subj.
Halifax	Wkg. Men's Coll.	Akroyd, E., M.P.	Gibb, G.	Jarmain, G. Stopford, W. H.	35	52	17	..	7	1	1 G. 1 B.	1 B.	5s. per subject.
Halifax	*Mech. Inst.*	*Stansfeld, J.*	*Watson, J.*	*Jarmain, G.*	..	..	..	..	..	..	..	..	10s. 6d.
„	*Sch. of Art*	„	*Fox, C. J.*	*Stopford, W. H.* *Holland, T.*	..	..	..	..	..	..	..	..	5s. ea. subj.
Hammersmith	*Training Coll.*	*O'Keeffe, Rev. D.*	*Kerckhoffs, J.*	*Graham, Rev. T.* *Livesey, T.* *Flannery, T.* *Enright, J.*	..	..	..	..	..	..	..	..	Nil.
„	*St. Peter's Sch.*	*Tidcombe, Rev. G. H.*	*Blackmore, C.*	*Kehde, H.*	..	..	..	..	..	..	..	..	2s. 6d. to 5s.
Hampton	Commercial Sch.	Burrow, Rev. J.	Raw, D. B.	Bickerton, A. W.	..	30	30	..	..	2	..	..	2s. 6d. ea. subject.
Handsworth	*St. Michael's Sch.*	*Anson, Rev. A.*	*Mordaunt, Rev. O.*	*Bulpitt, W. T.*	..	..	..	..	..	..	..	..	1s.
Harborne (Birmingham)	*Y. M. Chr. Assoc., High Street*	*Roberts, Rev. E.*	*Collier, J.*	*Price, E. G.*	..	..	..	..	..	..	..	..	1d. per lecture.
„	*Smethwick N. S.*	*Simcox, Rev. T. G.*	*Young, Rev. J.*	*Sears, H.*	..	..	..	..	..	..	..	..	1d. per nt.
Haslingden	Mech. Inst.	Whittaker, L.	Heap, B.	Shore, T. W.	18	25	7	..	3	1	..	..	2s. to 3s.
Hayfield (Stockport)	*Birch Vale Inst.*	*Rudd, Rev. F. A.*	*Marsden, J.*	*Hurst, W.*	..	..	..	..	..	..	..	..	2s.

Helston	Gram. Sch.	Penberthy, F.	Hosking, J. H.	Tyacke, W.	..	20	20	..	..	1	..	..	15s. ea. subj.
Hereford	*Blue Sch.*	*Anthony, C.*	*Budd, Rev. E. J. S.*	*Jeffery, W.*	..	..	..	..	..	..	..	..	6d. to 2s. 6d. per qr.
Hetton (Fence-houses)	Barrington Sch.	Wood, L.	Widowfield, F.	Rowden, W. T. Kernick, R.	..	88	88	..	..	14	..	..	Nil.
Heywood	Mech. Inst.	Fenton, A.	Fairbrother, G.	*Crawshaw, J.* *Duerr, G.*	44	18	..	26	8	2	..	..	2s. per qr.
Highgate	*Nat. Sch.*	*Dalton, Rev. C. B.*	*Smith, Rev. R. P.*	*Dronfield, J.*	..	..	..	..	..	..	..	..	4d. per wk.
Hingham (Norfolk)	Nat. Sch.	Tallent, J. T.	Hardinge, Rev. J. R.	Wilson, W. R. H.	..	22	22	..	..	..	..	..	1s. to 1s. 6d. per subj.
Holbeck (Leeds)	*Mech. Inst.*	*Ward, Rev. P.*	*Lister, C.*	*Tinker, H.* *Catton, R.*	..	..	..	..	..	..	..	..	3s. to 5s.
"	*Wes. Day. Sch.*	*Bunting, Rev. W.*	*Ellis, J.*	*Brears, W.*	..	..	..	..	..	..	..	..	Nil.
Holmfirth (Huddersfield)	*Wkg. Men's Club*	*Harpin, J.*	*Lomax, H.*	*Jarmain, G.* *Nettleton, W.* *Frost, J.*	..	..	..	..	..	..	..	..	5s.
Hornsey	*Brit. Sch.*	*Bird, H.*	*Maynard, R. R.*	*Leigh, S.*	..	..	..	..	..	..	..	..	1s. per mo.
Horwich (Bolton).	*Nat. Sch.*	*Pigot, Rev. H. S.*	*Evans, J.*	*Brown, T.*	..	..	..	..	..	..	..	..	5s.
Huddersfield	Mech. Inst.	Marriott, W.	Bate, J.	Jarmain, G. Nettleton, W. Kershaw, T.	23	60	37	..	9	13	..	..	9s. to 12s.
Huddersfield	*St. Paul's Sch.*	*Snowden, Rev. E.*	*Lawrence, Rev. G. G.*	*Brears, W.*	..	..	..	..	..	..	..	..	1s. to 2s. 6d.
"	*Mech. Inst., Milnsbridge.*	*Armitage, G.*	*Taylor, B.*	*Whiteley, H.*	..	..	..	..	..	..	..	..	2s. 6d.
Hull	Navigation Sch.	Whitaker, T.	Wilson, H. S.	Scaping, Z.	80	79	..	1	50	7	2 G. 1 S. 1 B.	1 G. 1 S.	Nil.
Hull	*People's Inst.*	*Bryson, J.*	*Raven, G.*	*Tinker, H.* *Read, J.* *Gill, H. S.*	..	..	..	..	..	..	..	..	5s. each subject.
"	*Day Street B. S.*	*Statham, Rev. W. M.*	*Stratton, T.*	*Spafford, W. A.*	..	..	..	..	..	..	..	..	4s.
Huntingdon	Walden's Sch.	Margetts, Rev. H.	Vesey, Rev. F. G.	Pascoe, J.	16	16	..	..	8	..	..	..	2s. 6d.
Hyde	Mech. Inst.	Thorneley, T.	Bradley, J.	Parnell, G. Taylor, T.	41	50	9	..	17	..	..	..	1s. each subject.
Ipswich	*Town Hall*	*Packard, E.*	*Drummond, H. P.*	*Vick, W.* *Griffiths, W. T.*	..	..	..	..	..	..	..	..	2s. 6d. per subject.
Jarrow-on-Tyne	*Mech. Hall and Inst.*	*McIntyre, J.*	*Wright, G.*	*Stokoe, R.* *Grice, J.* *Crawford, S.* *Wallbank, J.*	..	..	..	..	..	..	..	..	2s. 6d. to 5s.
Keighley	*Mech. Inst.*	*Holden, I.*	*Smith, S.*	*Stevenson, A.*	..	..	..	..	..	..	..	..	5s. ea. subj.
Kendal	Post-office Yd.-room	Whitwell, J., M.P.	Braithwaite, C., jun.	Prosser, W. Brown, J.	..	92	92	..	..	2	..	..	5s. to 21s.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
Kersley (Bolton).	Brit. Sch.	Fletcher, Rev. J.	Gee, S.	Collins, J.	..	14	14	..	..	..	..	..	Nil.
Kettering	North End N. S.	Lindsay, Rev. H.	Eldred, G.	Sturgess, W.	52	53	1	..	23	7	..	..	Nil.
"	Brit. Sch.	Toller, W.	Gotch, H. G.	Brooks, W. W.	..	36	36	..	..	1	..	..	Nil.
Kilburn	St. Mary's Schs.	Kennion, Rev. A.	Willis, W.	Kehde, H.	..	30	30	..	..	6	..	..	2*s.* 6*d.* to 5*s.*
Kinver	Wire Mill	Hodgson, Rev. J.	Bolton, Rev. W. H.	Packer, M. W.	25	18	..	7	5	..	..	..	2*s.* 6*d.* to 10*s.* 6*d.*
Kirkstall (Leeds).	*St. Stephen's Sch.*	*Tunstall, W.*	*Barrett, Geo.*	*Carr, G. S.*	..	..	..	..	..	..	..	..	10*s.* 6*d.*
Lamerton (Tavistock)	*School-room*	*Philpotts, Rev. H. J.*	*Sly, T.*	*Peddle, W. J.*	..	..	..	..	..	..	..	..	2*s.* 0*d.* ea. subject.
Lamport (Northants).	Endowed Sch.	Isham, Sir C. E., Bt.	Curtis, W.	Graves, J. J.	..	53	53	..	..	..	..	..	Nil.
Lancaster	Mech. Inst.	Davis, Rev. D.	Gibson, T.	Prosser, W.; Gregson, R.	48	80	32	..	9	10	..	..	1*s.* 3*d.* to 5*s.*
"	Sch. of Art	Lee, Rev. F. T.	Storey, W.	Gilbert, H.	..	12	12	..	..	4	..	..	10*s.* per yr.
Lancaster	*Boys' Nat. Sch.*	*Roper, W.*	*Seward, A.*	*Armstrong, J. N.*	..	..	..	..	..	..	..	..	1*s.*
Launceston	*Gram. Sch.*	*White, G. G.*	*Clarke, Rev. S. C.*	*Rowe, W.*	..	..	..	..	..	..	..	..	2*s.* 6*d.* to 10*s.*
Leeds	Mech. Inst.	Luccock, J. D.	Dayson, J. O.	Ward, G.; Hick, T.	47	96	49	..	25	25	1 B.	2 S. 1 B.	5*s.* to 21*s.* per subj.
"	Sch. master's Class No. 1 and 2; *Sch. mistress' Cl.*	Heaton, J. D.	Sales, H. H.	Ison, E.; Smith, W.; Hick, T.	..	37	37	..	..	5	..	..	10*s.* per subject.
"	Y. M. Chr. Assoc.	Barran, J.	Smith, W. H.	Jefferson, S.; Tiffany, J. B.	..	36	36	..	..	1	..	..	5*s.* per qr.
"	Wkg. Men's Inst.	Lupton, D.	Lupton, D., jun.	Brears, W.	..	17	17	..	..	1	..	..	2*s.* per qr.
"	St. Peter's Sch.	Woodford, Rev. J. R.	Wood, Rev. F. J.	Ison, E.; Edge, H.	..	27	27	..	..	1	..	..	2*s.*6*d.* to 3*s.* ea. subj.
Leeds	*Sch. of Art*	*Luccock, J. O.*	*Wardman, H.*	*Puckett, R. C.*	..	..	..	..	..	..	..	..	4*s.* per qr.
"	*Art and Sci. Inst.*	*Henderson, Rev. W. G.*	*Nussey, G. H.*	*Smith, W.; Stevenson, A.; Jarmain, G.; Tinker, H.*	..	..	..	..	..	..	..	..	5*s.* to 21*s.* per subject.
"	*St. Mark's N. S.*	*Kettlewell, Rev. S.*	*Abbott, Rev. J. S.*	*Weaver, G.*	..	..	..	..	..	..	..	..	Nil.

,,	St. Simon's Sch.	Whitby, Rev. T.	Beverley, W. A.	Wright, G.	..	..	..	..	..	..	..	..	1s.
,,	Hunslet M. I.	Blackburn, E.	Simpson, C.	Jefferson, S.	..	..	..	..	..	..	..	..	5s. per sess.
Lees (Manchester)	Ch. Sch.	Higson, J.	Whittaker, Rev. R.	Kershaw, T.; Lord, T.	33	35	2	..	11	6	..	..	7s.
Leicester	St. Martin's Sch.	Vaughan, Rev. D. J.	Bouser, Rev. J. A.	Atkins, E.	58	100	47	..	16	11	..	1 B.	2s. 6d. to 21s. each subject.
,,	St. Margaret's N. S.	Jones, Rev. T.	Pertwee, Rev. A.	Padmore, S.	5	57	52	..	..	..	..	..	2s. 6d.
Leicester	Great Meeting Sch.	Rowlett, W.	Kempson, W.	Hepworth, J.	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
,,	Belgrave N. S.	Stephens, Rev. R.	Ellis, A.	Foister, J. S.	..	..	..	..	..	..	..	..	1s. ca. subj.
Leigh (Lanc.)	Pennington Ch. Ch. N. S.	Tunnicliffe, R.	Cronshaw, Rev. C.	Steeple, J.	..	..	..	..	..	..	..	..	4s.
Leighton Buzzard (Beds.)	W. M. Mut. Imp. Soc.	Harris, T.	Page, W. S.	Lewis, E. W.	..	22	22	..	..	..	..	..	2s. 6d. to 10s.
Lewes	Sch. of Sci. and Art	Godlee, B.	De Putron, Rev. P.	Fisher, A.	..	10	10	..	..	..	..	..	2s. per mo.
Limehouse	St. John's N. S.	Carr, Rev. C. H.	Ogle, Rev. J. L.	Murché, V. T.	..	..	..	..	..	..	..	..	1s.
Lincoln	Trg. Coll.	Jarvis, J. K.	Blenkin, Rev. F. B.	Nelson, Rev. H.	..	45	45	..	..	1	..	..	Nil.
Lincoln	Sch of Art	Ruston, J.	Gibney, Rev. J. S.	Taylor, E. R.	..	..	..	..	..	..	..	..	2s. 6d. per month.
Lindley (Huddersfield)	Mech. Inst.	Town, Rev. J. W.	Brook, J. W.	Knowles, M.	..	..	..	..	..	..	..	..	1d. per wk. to 3s. 6d. course.
,,	Nat. Sch.	,,	,,	,,	..	..	..	..	..	..	..	..	1d. per wk. or 3s. 6d. session.
Liskeard	Lit. Inst.	Isaac, J. C.	Jewell, C. W.	Corin, W. J.; Rider, A. J.	..	..	..	..	..	..	..	..	4s. each subject.
Littleborough (Rochdale)	Church Sch.-room	Carter, Rev. T.	Winterborn, Rev. B. T.	Allberry, E.	..	..	..	..	..	..	..	..	3s.
Liverpool	Sci. Sch. Free Liby.	Lamport, W. J.	Gregson, S. L.	Carter, W.; Watt, J.; Hayes, J.	60	130	70	..	18	16	..	..	Total amt. 49l. 5s. 3d.
,,	Institute	Holt, P. H.	Sharp, C.	Adair, S.; Ewart, E. B.; Lander, G.; Lewis, J. T.	107	150	43	..	38	34	..	1 G. 2 B.	3s. per qr. to 10s. 6d. per sess.
Liverpool	Trg. Coll., Mount Pleasant	Stokes, S. N.	Guy, Rev. R. E.	Lomax, Miss; McGarvie, Miss	..	..	..	..	..	..	..	..	Nil.
Llanboidy (St. Clears).	Nat. Sch.	Powell, W. R. H.	Owen, S.	Duckett, J. B.	..	..	..	..	..	..	..	..	1s. to 5s.
Llanelly	Copper Wks. Sch.	Nevill, C. W.	Morgan, R.	Jones, J.; Rees, W.; Jones, A.	73	88	15	..	28	15	..	..	2s. to 3s. per subject.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
Llanelly	*Loughor N. S.*	*Williams, E.*	*Jenkins, Rev. E.*	*Smith, A.*	..	..	..	..	..	..	..	..	2*s.* ea. subj.
London:—													
Battersea	Trg. Coll.	MacCarthy, Rev. J.	Dugard, F.	Faunthorpe, Rev. J. P.; Roberts, G.	80	80	..	..	98	17	1 G. 1 S.	..	1*s.* each subject.
"	Christ Ch. Sch.	"	Forster, Rev. G. W.	Brown, H.	..	56	56	..	..	1	..	..	1*s.*
Battersea	*St. John's N. S.*	*Thompson, Rev. E.*	*Hatcher, W. H.*	*Annis, S.*	..	..	..	..	..	..	..	..	5*s.*
"	*Class Room Wes. Chapel.*	*Kelly, Rev. C. H.*	*Molineux, J.*	*Tyrer, T.*	..	..	..	..	..	..	..	..	2*s.* 6*d.* to 5*s.*
Bayswater	*St. Matthew's P. S.*	*Hunter, Ven. Arch.*	*Lovely, Rev. G.*	*Ricks, G.*	..	..	..	..	..	..	..	..	Nil.
Bermondsey	Christ Ch. Sch.	Martin, Rev. R. M.	Shaw, F.	Child, T.; Jones, T.	22	12	..	10	4	4	..	..	5*s.*
Bethnal Green	Birkbeck School, Cambridge Rd.	Rogers, Rev. W.	Runts, G.	Pike, R. W.; Bithell, R.; Hughes, W. H.; Heney, J.	106	132	26	..	33	4	..	..	1*s.* to 2*s.* 6*d.* ea. subj.
"	Nat Sch., Church Row	Hansard, Rev. S.	Avenell, W. C.	Simpson, B.; Moss, H.; Lovell, A.; Payne, J.; Angel, H.	115	144	29	..	13	10	..	..	5*s.* adults, 2*s.* boys.
Bethnal Green	*St. James the Less N. S.*	*Moon, Rev. G.*	*Dixon, T.*	*Lowres, J.*	..	..	..	..	..	..	..	..	1*s.* per mo.
"	*Abbey Street Sch.*	*Buxton, E. N.*	*Reeve, T. F.*	*Crouch, W.*	..	..	..	..	..	..	..	..	6*d.* ent. fee.
Blackfriars Road	South London Wkg. Men's Coll.	Huxley, T. H.	Rossiter, W.	Bithell, Dr.; Hulme, F. E.; Mitchell, C. T.; Tyssen, A. D.	..	29	29	..	..	..	..	..	3*s.* 6*d.* to 5*s.* ea. subj.
Borough Rd. / "	Trg. Coll. / Model Sch.	Owen, H.	Bourne, S.	Curtis, J. C.; Smith, A. F.; Barkby, E.; Langton, J.	69	159	90	..	28	25	..	..	Nil.
Brixton Hill	Wkg. Men's Club	McArthur, W., M.P.	Gibbons, G.	Bradbury, A. A.	9	20	11	..	8	8	..	..	5*s.* ea. subj.
Camberwell	*St. Matthews' Inst.*	*Plindt, Rev. G. K.*	*Baise, A.*	*Parry, P.*	..	..	..	..	..	..	..	..	7*s.* 6*d.*

Charterhouse	*St. Thomas' Sch.*	*Rodgers, Rev. J.*	*Uridge, W.*	*Parker, J.* *Simpson, B.*	..	..	..	..	..	..	..	..	5s.
Chancery Lane	Birkbeck Lit. Inst.	Campbell, D.	Knott, J. W.	Vaughan, W. Hopper, T. Chaloner, G. Davy, W. Wilson, W. J. Zorth, G. G.	..	47	47	..	..	1	..	..	1s. to 5s. per qr.
Chelsea	St. Mark's Coll.	Batty, Rev. W. E.	Quilter, J. S.	Eastburn, Rev. C. F. Byatt, H. Dawe, Rev. C. S. Lawson, W. Atkins, G.	48	79	31	..	62	14	..	..	Nil.
"	*College St. Tech. Sch.	Dilke, Sir C. W., Bart., M.P.	Demaus, Rev. R.	Bickerton, A. W. Davies, S. W. Coles, H. J. Turner, H. Ewings, J. Ashby, J. Jackson, G.	153	177	24	..	46	27	1 S. 1 B.	1 S. 1 B.	2s. 6d. to 7s. 6d.
City Rd., E.C.	*Finsbury Coll.*	*M'Auslane, Rev. A.*	*Skuse, W. H.*	*Bond, G.*	..	..	..	..	..	..	..	..	2s. 6d.
Clapham	*Christ Church Sch.*	*Abbott, Rev. B.*	*Helps, Rev. W. S.*	*Annis, S.*	..	..	..	..	..	..	..	..	5s.
"	*St. James' Sch.*	*Price, Rev. A. C.*	*Wainwright, W.*	*Taylor, W.*	..	..	..	..	..	..	..	..	4s.
Clerkenwell	*Technical Sch.*	*Pratt, H.*	*Taylor, J.*	*Bickerton, A. W.* *Coles, H. J.*	..	..	..	..	..	..	..	..	3s. 6d.
"	*St. Peter's N. S.*	*Sharp, Rev. B. O.*	*Wednell, A. C.*	*Swanson, W.* *Nankivell, G.*	..	..	..	..	..	..	..	..	5s.
Eaton Square	*St. Peter's Coll. Sch.*	*Samuelson, W.*	*Pococke, H.*	*Gibsone, Rev. B. W.* *Gwinnell, W. F.*	..	..	..	..	..	..	..	..	Not yet arranged.
Edgeware Rd.	*Christ Chapel N. S.*	*Campe, Rev. C.*	*Randall, E. B.*	*Simpson, B.*	..	..	..	..	..	..	..	..	Nil.
Goswell Road	St. Barnabas' Sch.	Ward, Rev. H.	Carter, J. H.	Conning, J. Jones, T.	..	27	27	..	..	1	..	..	5s.
Grays Inn Rd.	St. Bartholomew's Sch.	Bird, Rev. R. J.	Dove, K.	Town, E. H.	..	80	80	..	..	25	..	..	1s.6d. per qr.
Hackney	St. Thomas Sq. Sch.	Picton, Rev. J. A.	Reynolds, A. W.	Bond, G. Weston, H. Ricks, G. Moss, H.	48	141	93	..	12	4	..	..	1s. to 2s. 6d.
Hackney (South)	*Parochial Sch.*	*Lockwood, Rev. G. P.*	*Wilkie, G. F.*	*Weston, H.* *Tremeer, C.* *Weston, Mrs. H.*	..	..	..	..	..	..	..	..	1s. ea. subj.
Hackney	*Parish Sch., Paradise Place.*	*Goodchild, Rev. T. O.*	*Baker, Rev. C. W.*	*Byatt, H.*	..	..	..	..	..	..	..	..	7s. 6d.
Hampstead Rd.	*St. James' N. S.*	*Hodson, Rev. C. W.*	*Thompson, Rev. G.*	*Hardy, J.*	..	..	..	..	..	..	..	..	2s.6d. ea. sub.
Haverstock Hill	*Orphan Wkg. Sch.*	*Smith, B. W.*	*Tyler, C.*	*Longstaff, J. W.*	..	..	..	..	..	..	..	..	Nil.

* Removed from Arthur Street.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
London—*cont.*													
Islington, Lower	Public Sch.	Fleming, Rev. W.	Wheatley, H. J.	Howard, J.; Angel, H.	145	185	40	..	38	14	..	..	4*s.* to 7*s.* 6*d.*
Islington	*Youth's Inst., St. George's Hall.*	*Faithfull, W.*	*Tabrum, E. J.*	*Fairmaner, W.*	..	..	..	..	..	..	..	..	4*d.* pr. wk. or 3*s.* per session.
"	*St. Thomas', Eve-rilda St.*	*Allen, Rev. G.*	*Allen, C. J.*	*Meyer, C.*; *Speer, G.*; *Fairmaner, W.*; *Hardy, J.*	..	..	..	..	..	..	..	..	3*s.*
"	*Wes. Sch.*	*McKenny, Rev. J.*	*Love, R. H.*	*Busbridge, W.*; *Yearsley, O.*; *Cleminson, J.*	..	..	..	..	..	..	..	..	5*s.*
Kensington	*School, Allen St.*	*Stoughton, Rev. J.*	*Trotman, S. H.*	*Bickerton, A. W.*; *Turner, H.*; *Coles, H. J.*	..	..	..	..	..	..	..	..	3*s.* 6*d.*
Kentish Town	Gospel Oak Sch.	Lee, Rev. C.	Wildy, A. S.	Weston, H.; Teather, H. W.; Feltham, E.	..	87	87	..	..	..	..	..	1*s.* ea. subj.
Kingsland	*Sch. of Art*	*Aveling, Rev. T.*	*Iliffe, W.*	*Swinstead, C.*	..	..	..	..	..	..	..	..	Nil.
Knightsbridge	Albert W. M. Club	(Included with College Street, Chelsea).											
Lambeth	Hercules Buildings	Lingham, J.	Jones, W. W.	Heller, T. E.; Child, T.; Young, G.; Browne, L.; Browne, E. L.; Groom, J. B.; Jones, T.; Furness, J.	155	209	54	..	18	..	1 S., 1 B.	..	5*s.* per sub.
"	Sch. of Art and St. Peter's Sch.	Gregory, Rev. G.	Herbert, Rev. G. W.	Sparks, J.; Bale, E.; Jennings, J.; Schenk, R.; Hayes, G.	..	36	36	..	..	3	..	..	1*s.* per mo. each subj.
Lambeth	*Lambeth Baths*	*Murphy, Rev. G. M.*	*Pamacott, A.*	*Ellis, A.*; *Morley, J.*; *Sadler, A.*	..	..	..	..	..	..	..	..	5*s.*

„	*Wes. Sch.*	*Simmonds, J.*	*Wheeler, T.*	*O'Leigh, R.*	..	..	..	..	..	..	..	..	1*d.* pr. week.
Leadenhall St., E.C.	City of London Coll.	Mackenzie, Rev. C.	Hanson, H. W.	Maxwell, T.; Hawker, G.; Northey, J.; Jewesbury, F. N.; Adams, H.	30	46	16	..	..	1	..	..	5*s.* to 10*s.* each subj.
Long Acre	Wilson Street Sch.	Whitmore, Rev. C. J.	Madden, B.	Duffy, F. P	..	19	19	..	..	..	..	..	6*s.*
Marylebone	Central Sch.	Eyre, Rev. C. P.	Goody, Rev. C. J.	Ricks, G.; Wren, J.; Baker, A.	48	86	38	..	2	1	..	..	1*s.* ea. subj.
„	New Quebec Club and Inst.	Fremantle, Rev. W. H.	Pope, F.	Dorrell, C. F.	..	28	28	..	..	1	..	..	5*s.*
Nine Elms	Lecture Room	Mather, Rev. W. M.	Sellar, F.	Bickerton, A. W.; Davies, S. W.; Jackson, G.	..	37	37	..	..	6	..	..	3*s.* 6*d.*
Notting Hill	*St. James' Square Tabernacle Sch.*	*Varley, Rev. H.*	*Day, W.*	*Barber, W. C.*	..	..	..	..	..	..	..	..	5*s.*
Old Kent Rd., S.E.	*St. Mary's Sch.*	*Snape, Rev. A. W.*	*Walsh, Rev. J. F. B.*	*Simpson, B.*	..	..	..	..	..	..	..	..	General sch. fee.
Paddington	Greville House	Merivale, J. L.	Deans, C.	Jones, T.; Bray, G.	31	48	17	..	10	6	..	..	Not yet fixed.
Paddington	*All Saints' N. S.*	*Steventon, Rev. E. H.*	*Mercer, Rev. W.*	*Ricks, G.*	..	..	..	..	..	..	..	..	Nil.
Peckham	*St. Mary's Coll.*	*Biggs, Rev. M.*	*Fry, F. W.*	*Bickerton, A. W.*	..	..	..	..	..	..	..	..	Nil.
Pimlico	*St. Saviour's Sch.; St. Gabriel's Sch.*	*Belcher, Rev. B.*	*Severn, W.*	*Annis, S.*	..	..	..	..	..	..	..	..	7*s.*
Poplar	Boys' Nat. Sch.	Nowell, Rev. T. W.	Fairbairns, W.	Gaze, E. H. J.; Saunders, J.	..	30	30	..	..	5	..	..	6*s.*
Poplar	*William St.*	*Walter, Rev. R. P.*	*Paton, Rev. J.*	*Wild, R.*	..	..	..	..	..	..	..	..	5*s.*
Regent Street	Royal Polytechnic	Mackenzie, Rev. C.	Cousens, J.	Hardy, J.; Downar, G. F.	46	55	9	..	19	7	1 G.; 1 S.; 3 B.	..	7*s.* 6*d.* to 15*s.* each subject.
St. John's Wood.	*Boys' Cath. Sch.*	*Mostyn, L.*	*Burke, Rev. W.*	*Carroll, J.*	..	..	..	..	..	..	..	..	2*s.*
Somers' Town	*Christ Ch. Nat. Sch.*	*Worsfold, Rev. T. N.*	*Maney, C.*	*Parry, P.*	..	..	..	..	..	..	..	..	5*s.*
„	*Brit. Sch.*	*Thorold, Rev. A.*	*Leftwich, H. T.*	*Busbridge, W.; Clark, C.; Ellercamp, H.; Newman, G.; Topple, C. J.*	..	..	..	..	..	..	..	..	5*s.*
Southwark	Nat. Sch., Swan St.	Moullin, Rev. D. A.	Bayles, W. J.	Parry, P.; Adams, H.	..	24	24	..	..	..	..	..	7*s.* 6*d.*
Spitalfields	*Sch. of Art*	*Vanner, J.*	*Hill, N.*	*Mills, S. F.; Rawson, W.*	..	..	..	..	..	..	..	..	2*s.* 6*d.* per month.
Tottenham Court Rd.	*St. John's W. M. I.*	*Coxhead, Rev. J. J.*	*Charlton, Rev. E. B.*	*Conning, J.; Browne, L.*	..	..	..	..	..	..	..	..	2*s.* to 4*s.* per subjt.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
London—*cont.*													
Vauxhall	L. and S. W. Rail. Inst., Brunsw. Ho.	Shepherd, Rev. C. P.	Grimsdick, C.	Parry, P.	..	10	10	..	..	3	..	..	5*s.* 6*d.* to 8*s.*
"	Baptist Sch.	Lawrence, Sir J. C., M.P.	Hearson, Rev. G.	Busbridge, W.; Clark, C.; Cleminson, J.; Newman, G.	..	45	45	..	..	5	..	..	5*s.*
Walham Green.	*St. John's Sch.*	*Batty, Rev. W. E.*	*Godrich, T.*	*Lawson, W.*	..	..	..	..	..	..	..	..	Nil.
Wandsworth	R.P. Fund, Boys' Sch.	Lindsay, General Hon. J.	Mugford, W. H.	Bickerton, A. W.; Turner, H.; Pomeroy, P. T.; Hart, J.	..	57	57	..	..	..	..	..	Nil.
Waterloo Road	Church St. Nat. Sch.	Johnston, Rev. J. A.	Quaif, W.	Busbridge, W.; Norman, C.; Thompson, R.	30	88	58	..	33	26	..	..	5*s.*
Westminster	Wes. Trg. Coll.	Hall, T. F.	Olver, Rev. G. W.	Sugden, W.; Kinton, J. L.; Langler, J. R.; Mansford, C.	29	94	65	..	28	25	..	..	Nil.
"	St. James the Less	Dickson, Rev. G. D. W.	Giveen, Rev. R. L.	Busbridge, W.; Yearsley, O.; Ellercamp, H.	..	41	41	..	..	11	..	..	5*s.*
Westminster	*Wkg. Men's Club*	*Maskell, Rev. J.*	*Payne, J.*	*Bickerton, A. W.*; *Turner, H.*; *Davies, S. W.*	..	..	..	..	..	..	..	..	Nil.
Luddenden Foot (Halifax)	Cong. Sch. Room	Whitworth, W.	Hillman, Rev. S. D.	Tattersall, A.	..	38	38	..	..	1	..	..	5*s.*
Lutterworth	*Cottage Sch.*	*Constable, Rev. J. P. G.*	*Tomlinson, Rev. R.*	*Bellow, Rev. W.*; *Fowler, J.*	..	..	..	..	..	..	..	..	6*d.* to 9*d.* per mnth.
Macclesfield	Modern Free School	-	Brooker, J.	Jackson, J.	48	48	..	..	..	..	..	..	10*s.* per qr.
Manchester	Mech. Inst.	Grave, J.	Shipley, G. H.	Brewer, R. F.; Mellor, J.; Tomkins, F.; Gee, W.; Richardson, H.; Richardson, J.; Davenport, T.	200	240	40	..	64	21	1 G. 1 S. 2 B.	3 G. 1 S. 3 B.	6*d.* per qr. to 1*s.* per session.
					..	..					..		

"	Roby Educ. Soc.	Booth, G.	Ellis, R. P.	Schofield, J.	30	12	..	27	9	2	..	..	3s. per qr.
"	Hulme W. M. Inst.	Booth, W.	Letch, G. A.	Richardson, J.; Richardson, H.; Jones, T.	31	38	7	..	12	4	..	..	1s. ea. subj.
"	St. George's Nat. Sch.	Lindsay, Rev. T.	Gregory, J.	Monks, P.	12	10	..	3	1	..	..	..	2s. ea. subj.
Manchester	*Owen's Coll. and Mech. Inst.*	*Rumney, R.*	*Lawton, T.*	*Angell, J.; Spriggs, C.; Bentley, A. W.; Thorpe, Dr.*	..	..	..	..	..	..	..	..	4s.
"	*Free Gram. Sch.*	*Armitage, Sir E.*	*Hodson, S. H.*	*Angell, J.; Watts, W. M.; Aldis, T. S.; Pritchard, E.*	..	..	..	..	..	..	..	..	Included in general school fee.
"	*Buildg. Trades Inst.*	*Huntingdon, Rev. W.*	*McLean, J.*	*Battye, J.; Bennion, J. A.; Haslam, W.*	..	..	..	..	..	..	..	..	2s. 6d. per quarter.
"	*Pres. Sch., Ancoats*	*Ross, Rev. J. M.*	*Carson, A.*	*Richardson, H.; Hurst, W.*	..	..	..	..	..	..	..	..	5s. each subject.
"	*Rusholme Pub. Hall*	*Mayson, J. S.*	*Wilde, E.*	*Monks, P.*	..	..	..	..	..	..	..	..	6s. per sess.
"	*St. Luke's School, Cheetham Hill Rd.*	*Chippendall, Rev. J.*	*Guest, Rev. T. H.*	*Napper, E. W.*	..	..	..	..	..	..	..	..	2s. 6d. per session.
Market Harborough	*Nat. Sch.*	*Follett, Rev. W. W.*	*Martin, W.*	*Price, W.*	..	..	..	..	..	..	..	..	1s. 6d. per term.
"	*Brit. Sch.*	"	"	*Robinson, A.*	..	..	..	..	..	..	..	..	1d. pr. night.
Marple (Stockport).	*Albert Sch.*	*Turner, W. H.*	*Walmsley, W.*	*Walker, J.*	..	..	..	..	..	..	..	..	Nil.
Melksham (Wilts).	*Brit. Sch.*	*Gore, A.*	*Palmer, T., jun.*	*Price, H. S.*	..	..	..	..	..	..	..	..	1s. to 2s. 6d.
Meltham, Huddersfield.	*Church Sch.*	*Watson, Rev. E. C.*	*Armitage, A. C.*	*Revell, W.*	..	..	..	..	..	..	..	..	2s. 6d.
Melton Mowbray.	Church School-room	Colles, Rev. W. M.	Willcox, W.	Greasley, J.	3	10	7	..	..	..	..	..	5s. per qr.
Merthyr-Tydfil	*Tydfil Sch.*	*James, C. H.*	*Johnstone, Rev. F. S.*	*Williams, E.; Heasley, R.*	..	..	..	..	..	..	..	..	1s. per mo. to 7s. 6d. per sess.
Middlesborough.	Church Association	Smith, Rev. A. C.	Blair, Rev. G. A.	Stead, W.	11	8	..	3	8	3	..	..	5s.
Middleton	National Sch.	Durnford, Ven. R.	Ward, Rev. C. B.	Wheeler, G. H.	22	35	13	..	17	1	1 B.	..	2s. 6d. ea. subject.
Middleton	*Parkfield, Holy Trin., C. N. S.*	*Jackson, T.*	*Bates, Rev. E.*	*Heywood, E.*	..	..	..	..	..	..	..	..	2s. 6d.
Millwall	Pres. Inst.	Dickson, Rev. J. H.	- - -	Farncombe, F.	..	16	16	..	..	..	..	..	4s.
Mirfield, (Dewsbury)	*Lit. Soc.*	*Johnson, J. M.*	*Barker, J.*	*Jarmain, G.; Snaith, W. A.*	..	..	..	..	..	..	..	..	5s.
Morley (Batley).	*Brit. Sch.*	*James, Rev. J.*	*Smith, W.*	*Harries, R. E.*	..	..	..	..	..	..	..	..	1s.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	Number of Individuals under Instruction. 1869.	Increase.	Decrease.	Number of Prizes. 1868.	Number of Prizes. 1869.	Number of Medals. 1868.	Number of Medals. 1869.	Fees paid by Students.
Mossley (Manchester)	Mech. Inst. - -	Jones, Rev. G. A. -	Jackson, T. -	Lord, T. - - Minshull, W. H. -	23	23	..	..	2	2	..	..	3s. ea. subj.
Moulton (Northampton).	*Nat. Sch.* - -	*Nethercote, H. O.* -	*Sanders, Rev. T.*	*Onn, W.* - - -	..	..	..	..	..	..	..	..	1d. pr. wk. to 6d. per month.
Mow Cop (Stoke-on-Trent).	*Nat. Sch.* - -	*Robinson, Rev. J. J.*	*Jamieson, W.* -	*Hodgins, B.* - -	..	..	..	..	..	..	..	..	2s. 6d. half-yearly.
Murton - -	Colliery Sch. -	Waters, Rev. R. -	Archbold, J. W. M. -	Rowden, W. T. - Kernick, R. - -	..	52	52	..	..	11	..	..	5s.
Nailsworth (Stroud) -	Nat. Sch. - -	Stokes, T. -	Thomas, E. T. W.	Smith, P. L. - -	..	8	8	..	..	1	..	..	1s. 6d. ea. subject.
Nelson in Marsden -	Lomeshaye Schs. -	Ecroyd, W. - -	Waddington, J.	Thompson, J. - Ashworth, J. - -	36	35	..	1	23	..	..	..	1s.
Newark-on-Trent -	Mech. Inst. - -	Godfrey, T. S. - -	Lammin, H. -	Webster, J. H. - Turnbull, J. -	34	31	..	3	3	1	..	..	2s. 6d. ea. subject.
Newcastle-on-Tyne -	Elswick Mech. Inst.	Maughan, Rev. W.	Allan, G. - -	Rowden, W. T. - Kernick, R. - - Cail, C. - - - Clark, W. N. - Pratt, R. - - Garthorne, M. - Hutchinson, G. H.	..	117	117	..	..	38	..	..	6s. per sess.
" -	Mech. Inst. - -	Gregson, J. L. -	McKendrick, J.	Ross, J. A. G. - -	..	16	16	..	..	2	..	..	5s. ca. subj.
Newcastle-on-Tyne -	*Stephenson Inst. Wellingt. Quay*	*Potter, A.* - -	*Goddard, A.* -	*Stokoe, R.* - - *Crawford, S.* - - *Grice, J.* - -	..	..	..	..	..	..	..	..	5s.
"	*Sch. of Art* - -	*Watson, J.* - -	*Leathart, J.* -	*Way, W. C.* - - *Harrison, W.* -	..	..	..	..	..	..	..	..	2s. 6d. per month.
Newcastle-under-Lyne.	*Sch. of Art* - -	*Broad, Rev. J. S.* -	*Earl, E.* - -	*Bacon, J. P.* - -	..	..	..	..	..	..	..	..	2s. per subj.
Newton Heath (Manchester).	All Saints (No. 2) Sch.	Hutchinson, Rev. W.	Hudson, T. -	Parnell, G. - -	18	18	..	..	5	1	..	..	5s.

Northallerton	*Institute*	*Mercer, Rev. T. W.*	*Loane, A. W.*	*Walton, J. S.* *Jackson, W.*	..	..	..	..	..	..	..	..	Nil.
Northampton	Museum, St. Giles' Square	Compton, Rev. Lord A.	Hensman, J. B.	Lees, C. Coleman, J. B.	115	191	76	..	30	12	1 B.	1 B.	From 6d. per mo. ea. subj. to 5s. per sess.
Northampton	*St. Sepulchre's N. S.*	*Butlin, Rev. W.*	*King, C. D.*	*Smart, H.*	..	..	..	..	..	..	..	..	6d. per mo.
North Ormesby	Church Inst.	Pennyman, J. S.	Sharrock, Rev. W. R.	Weatherill, R. Casson, T.	7	5	..	2	4	..	..	..	2s. 6d.
North Shields	*Free Library*	*Shotton, E.*	*Edington, J. S.*	*Wheatley, M. J.* *Lambton, J. W.* *Proctor, H. R.*	..	..	..	..	..	..	..	..	5s. to 10s. 6d. each subj.
"	*St. Peter's Sch.*	-	*Hicks, H.*	*Stokoe, R.* *Crawford, S.* *Bewick, T.*	..	..	..	..	..	..	..	..	5s.
Norwich	*Presbyterian Sch.*	*Smyth, Rev. J. D. H.*	*Freeman, J.*	*Pinder, T. R.* *Claxton, R. L.* *Taylor, J. E.* *Goggs, R. G.* *Wright, J. D.*	..	..	..	..	..	..	..	..	1s. to 5s.
Norwich	Thorpe Hamlet N. S.	Owen, Rev. S. J.	Caley, J. W.	Marsh, W. H.	..	8	8	..	..	..	..	..	2s. 6d. to 5s.
Nottingham	Mech. Inst.	Morse, Rev. F.	Thurlow, R.	Wilson, E. Major, H. Elder, G. Smith, G. E. Taylor, W.	61	232	171	..	17	4	..	..	2s. to 10s.
Oadby (Leicester).	*Nat. Sch.*	*Gordon, Rev. T. W. W.*	*Lee, Rev. W. H.*	*Hoyle, W. H.*	..	..	..	..	..	..	..	..	1s.
Oldbury	Nat. Sch.	Taylor, Rev. W. T.	Gill, J.	Spencer, P.	61	68	7	..	12	1	..	..	1d. per night or 4d. week.
"	Messrs. Chance's Inst.	Chance, H.	Chance, A. M.	Horton, F. C.	14	76	62	..	..	..	..	..	3s. ea. subj.
Oldham	Sci. and Art Sch.	Platt, J., M.P.	Bailey, T.	Phythian, J. P. Philip, J. Walters, C.	80	98	18	..	42	13	..	1 S.	7s. 6d.
"	Glodwick Inst.	Harrop, E.	Green, J.	Kershaw, T.	20	76	46	..	14	8	..	..	5s.
"	Analytic Lit. Inst.	Yates, J.	Hall, R.	Taylor, W. Haslam, W.	44	40	..	4	16	13	..	..	6d. per mo. 2s. per qr.
"	Mech. Inst., Werneth	Taylor, J.	Mellor, W.	Mellor, J.	33	34	1	..	14	1	..	..	1s. 6d. per qr.
Openshaw	Ashbury Carriage Works	Airey, Rev. J. P.	Ashbury, T., jun.	Tomkins, E. Tomkins, W.	..	29	29	..	..	9	..	..	5s.
"	Wes. Sch.	Tyler, Rev. G.	Kay, J., jun.	Hurst, W.	..	30	30	..	..	..	..	..	2s. 6d. ea. sub.
Oswaldtwistle (Blackburn).	*Wes. Schs.*	*Holbrey, Rev. G.*	*Grimshaw, W.*	*Hargreaves, W.*	..	..	..	..	..	..	..	..	1s. 6d. per session.
Oswaldtwistle	*Bush Sch.*	*Underwood, Rev. W. J.*	*Smith, J.*	*Lucas, J.*	..	..	..	..	..	..	..	..	6d. per mo.
Oundle (Northants).	*Brit. Sch.*	*Siddons, G.*	*Hill, J.*	*Roe, R. G.*	..	..	..	..	..	..	..	..	1s. to 2s. 6d.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
Oxford *Oxford*	Town Hall *Wes. Sch.*	Liddell, Very Rev. H. G.	Alden, E. C.	Gubb, E. J. Richardson, J. Eagleston, J. Macdonald, A.	..	17	17	..	..	7	..	..	5s. to 10s. per subj.
Padiham	Nat. Sch.	Fox, Rev. J. H.	Bussell, Rev. F. V.	Thompson, J.	10	11	1	..	..	..	..	..	Nil.
Padiham	*Wes. Sch.*	*Kent, Rev. R. B.*	*Stephenson, W.*	*Hargreaves, W.*	..	..	..	..	..	..	..	..	Nil.
Patricroft (Manchester)	Mech. Inst.	Wilson, R.	Hewitt, J.	Tomkins, H. Tomkins, W. Slater, J. K.	27	18	..	9	17	8	1 S. 1 B.	2 G., 1 B.	2s. to 4s. 6d.
Pavenham	Ch. of Eng. Sch.	Tucker, J.	Ram, Rev. S. J.	Glover, A. W.	..	19	19	..	..	1	..	..	1s. ea. subj.
Pembroke Dock	Mech. Inst.	Cocks, J.	Sinnette, G. M.	Fitse, W. J.	..	15	15	..	..	..	..	..	5s. to 10s.
Pendeen (Penzance).	Nat. Sch.	Aitken, Rev. R.	Bennetts, J.	Oats, F.	..	7	7	..	..	..	..	..	2s. 6d. to 5s.
Pendleton (Manchester).	Mech. Inst.	Barrett, R. H.	Whitehead, A. H.	Beever, J.	20	19	..	1	4	2	..	..	2s. 6d. each subject.
Penzance	Sch. of Art	Downing, N. B.	Rodd, W. H.	Geoffroi, H. M. Bettany, G.	24	28	4	..	4	8	..	..	Nil.
Penzance	*Sancreed N. S.*	*Pascoe, H.*	*Collyns, J. M.*	*Cridland, T.*	..	..	..	..	..	..	..	..	5s. per sess.
Peterborough	Trg. Coll.	Skrimshire, Rev. A.	Savigar, J.	Tomlinson, J. Girling, R. G. S.	..	37	37	..	..	2	..	..	4s. 6d. ea. subject.
Pitsford (Northants).	*Nat. Sch.*	*Markham, H. P.*	*Evans, Rev. J. M.*	*Carter, G.*	..	..	..	..	..	..	..	..	2s. to 2s. 6d.
Plumstead	Burrage Road	McAlister, Rev. J. A.	Hammond, J.	Shipman, C. Downar, G. F. Farlie, J. L. Williams, R. Jones, T.	57	85	28	..	58	15	..	1 G., 1 S.	5s. to 10s.
Plumstead (Kent)	*St. James' Sch.*	*Robertson, Rev. A.*	*Raynes, A. T.*	*Busbridge, W.* *Hopper, T.* *Ellis, A.* *Charlesworth, T.*	..	..	..	..	..	..	..	..	5s.
Plymouth	Courtenay Street	Bate, C. S.	Cawse, J. H. M.	Merrifield, J. Rickard, G. Rider, A. Balkwill, F. P. Hodge, H. Sargent, R. E. Shopland, S. Hingston, C. A.	163	141	..	22	81	40	1 G. 3 S. B. 4	1 B.	2s. 6d. ea. subject.

"	Navigation Sch.	Hill, R.	Cuming, W. B.	Morrifield, J.	344	241	..	103	..	1	..	..	1s. per wk.
"	Charles Nat. Sch.	Greaves, Rev. H. A.	Cuddeford, T.	Evers, H. Evers, H. G. Bowden, J. T. Clark, R. G.	..	74	74	..	..	15	..	..	2s. 6d. per quarter. 5s. per term.
Portland	Grove Sch.	Clifton, G.	Hill, Rev. A.	Moore, E. W.	30	23	..	7	2	..	..	..	Nil.
Portsmouth	*Nat. Sch.*	*Grant, Rev. E. P.*	-	*Horn, H.* *Rockett, J. R.* *Laws, J.*	..	..	..	..	..	..	..	..	2s. per mo. each subj.
Preston	Inst., Avenham	Myres, J. J.	Newsham, W.	Cope, J. G. Gilbert, H.	57	79	22	..	30	13	1 S., 1 B.	1 S.	3s. to 10s.
Queensbury (Halifax).	*Nat. Sch.*	*Foster, W.*	*Hyatt, Rev. J. C.*	*Harrison, J.*	..	..	..	..	..	..	..	..	5s.
Rawtenstall	Mech. Inst.	Whitehead, J. B.	Wardleworth, W.	Tomkins, E. Tomkins, W.	55	41	..	14	33	14	..	..	4s.
"	Irwell Inst.	Ashworth, R.	Ashworth, H. H.	Thornley, G.	..	12	12	..	..	..	..	..	1s.
Reading	*Sch. of Art*	*Taylor, J. O.*	*Brown, W.*	*Havell, C.*	..	..	..	..	..	..	..	..	5s.
Redditch	Lit. Inst.	Bartleet, R. S.	Sparrow, S.	Bryant, J. E.	..	40	40	..	..	..	..	..	1s. 6d. per quarter.
Redruth	The Institute	Mitchell, T.	Grylls, W. M.	Pender, W.	10	54	44	..	2	..	..	..	2s. 6d.
Retford	*Wes. Day Sch.*	*Midgeley, Rev. J.*	*Liller, W.*	*Reatchlous, H. N.*	..	..	..	..	..	..	..	..	2d. and 3d. per week.
Richmond (Surrey).	*Petersham Brit. Sch.*	*Nott, Rev. P. W.*	*Blyth, Rev. F. C.*	*Smith, E. W.*	..	..	..	..	..	..	..	..	2s. 6d.
Riddings (Derbysh.)	Mut. Imp. Soc.	Walsh, Rev. T. H.	Wood, S. A.	Fowler, J. Pine, W. F. Booth, J.	..	28	28	..	..	..	..	1 B.	Nil.
Ripon	*Female Trg. Coll.*	*Hedley, Rev. T.*	*Ward, Rev. J. M.*	*Mustard, Miss*	..	..	..	..	..	..	..	..	Nil.
Rochdale	Brit. Sch.	Mansell, G.	Belmont, E.	Tomkins, E. Tomkins, W. Duerr, G. Wheeler, G. H.	47	114	67	..	18	27	..	1 B.	6s.
Rothwell (Kettering).	*Brit. Sch.*	*Hafford, C.*	*Palmer, C.*	*Brooks, W. W.*	..	..	..	..	..	..	..	..	Nil.
Rowley Regis (Dudley).	*Nat. Sch.*	*Ward, Rev. T.*	*Jukes, W.*	*Parrott, E. B.*	..	..	..	..	..	..	..	..	2d. per wk.
Royton (Manchester).	Nat. Sch.	Whitaker, R.	Hill, Rev. R.	Taylor, W.	54	43	..	11	8	3	..	..	10d. per mo.
St. Austell (Cornwall)	*Nat. Sch.*	*Coode, A.*	*Ball, A. W.*	*Dyke, E. G.*	..	..	..	..	..	..	..	..	3s. 6d. ea. subject.
St. Burian (Cornwall).	"	*Coulson, Rev. T. B.*	*Thomas, W.*	*Kissell, E.*	..	..	..	..	..	..	..	..	5s.
St. Helen's	Commercial Sch.	Mocatta, Rev. W. A.	Walthew, Rev. J. H.	Bournes, T.	23	20	..	3	4	..	..	..	2s. 6d.
St. Ives	*Nat. Sch.*	*Goldie, Rev. C. D.*	*Roffe, Rev. A. A.*	*Myhill, C.*	..	..	..	..	..	..	..	..	Nil.
St. Just	Institution	Boyns, R., 1st	Boyns, R., 2nd	Oats, F. George, T.	14	8	..	6	..	..	..	..	2s. 6d. each subject.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
Salford	Wkg. Men's Coll.	Davies, T.	Plant, J.	Richardson, J. Holl, J. Law, E. Monks, P. Shorrocks, J. H.	53	80	27	..	11	15	..	1 B.	6*d.* & 1*s.* per. qr.
Salford	*Wes.Sch.,Broughton Road*	*Lawn, W. S.*	*Bowman, H.*	*Thornton, J.*	..	..	..	..	..	..	..	..	1*d.* & 2*d.*, some free.
Salisbury	*Sch. of Art*	*Hamilton, Very Rev. H. P.*	*Wilton, W. J.*	*Fraser, J. P.*	..	..	..	..	..	..	..	..	2*s.* per mo.
Saltaire (Bradford).	Lit. Inst.	Kelly, Rev. W.	Haley, F.	Severs, G.	..	24	24	..	..	2	..	..	2*s.* 6*d.*
Saltley (Birmingham)	Trg. Coll.	Smythe, Rev. P. M.	Smith, Rev. F.	Haworth, Rev. T. J. Long, J. Bulpitt, W. T.	20	66	46	..	37	16	..	..	Nil.
Scarborough	Mech. Inst.	Champley, R.	Delamere, N. H.	Beever, J. Fox, C. B. Potter, F. Yewdall, J. H.	..	18	18	..	..	..	..	..	2*s.*6*d.* each subject.
Seaham (Durham)	Infant Sch.	Cust, Rev. D. M.	Warham, W.	Rowden, W. T. Jack, D.	..	33	33	..	..	6	..	..	3*s.* 6*d.*
Seaton Delaval (Durham)	Colliery Sch.	Forster, T. E.	Sanderson, T.	Rowden, W. T. Kernick, R. McDougal, T.	..	54	54	..	..	8	..	..	5*s.*
Shaw (Oldham)	Nat. Sch.	Crompton, J.	Bartleet, Rev. S. E.	Taylor, W. Newton, I.	..	28	28	..	..	1	..	..	10*d.* per mo.
Sheerness	*Brit. Sch.*	*Bryant, Rev. G.*	*Blackman, I.*	*Brazier, C.* *O'Donoghue, D.*	..	..	..	..	..	..	..	..	5*s.*
Sheffield	St. Paul's Sch.	Moore, T.	Darbyshire, Rev. B. S.	Sanderson, N. Harrison, G.	..	23	23	..	..	..	..	..	21*s.*, half returned if examd. Boys 1*s.* 6*s.*
"	Ch. Inst., St. James' Street	Salo, Rev. T.	Baker, W.	Sanderson, N. Sutton, J. Harrison, G.	..	35	35	..	..	5	..	..	6*s.* to 8*s.*
"	Ch. and Educ. Inst.	Foster, Rev. T.	Wardlow, C.	Allen, A. H.	..	15	15	..	..	..	..	..	5*s.*
Sheffield	*Park Wes. Sch.*	*Hargreaves, Rev. J.*	*May, T.*	*Harrison, G.*	..	..	..	..	..	..	..	..	3*s.*
"	*Mech. Inst.*	*Moore, T.*	*Dawson, G.*	*Harrison, G. H.*	..	..	..	..	..	..	..	..	

"	*Sch. of Art*	*Hobson, J.*	*Wightman, A.*	*Cox, W.*	..	..	..	..	..	..	..	..	15s. the session.
Shelton (Hanley).	*Nat. Sch.*	*Ashworth, T.*	*Strick, J.*	*Nevill, Rev. S. T.*	..	..	..	..	..	..	..	..	1d. per nt.
Shrewsbury	Sch. of Art	Humphreys, J. R.	Tasker, J.	Noyes, H. J.	..	4	4	..	..	1	..	..	5s. to 21s.
Skelmanthorpe (Huddersfield).	*Nat. Sch.*	*Newland, Rev. H.*	*Drummond, O.*	*Fawcett, J. L.*	..	..	..	..	..	..	..	..	2s.6d. ea. sub.
Slough	Mech. Inst.	Thompson, Rev. W. O.	Ward, W. H.	Dorrell, J. Dorrell, U. F. Dorrell, H. B. Davis, G. E.	22	53	31	..	4	12	..	..	Nil.
Southampton	Hartley Inst.	Chipperfield, R.	Le Feuvre, J. B.	Bond, F. T. Ranken, F. A.	40	146	97	..	1	4	..	..	5s. to 15s.
Southminster	Nat. Sch.	Page, W., jun.	Berkeley, Rev. G. C.	Fleming, J.	21	22	1	..	2	2	..	..	Nil.
Southport	Athenæum	Boothroyd, S.	Craven, R.	Spriggs, C.	..	14	14	..	..	1	..	..	2s. per qr.
South Shields *South Shields* "	Mech. Inst. *St. Hilda's* *JarrowChem.Wks.*	Stevenson, J. C., M.P.	Noble, J.	Legat, A. Denham, J. S. Armstrong, L. Crease, J. R. Rowden, W. T. Tyler, F. G. Ross, J. A. G. Grice, J. Hill, D. Meek, J. Kernick, R.	..	112	112	..	..	8	..	..	5s.
"	*Tyne Docks M. I.*	*James, W.*	*Powlson, S.*	*Walbank, J.*	..	..	..	..	..	..	..	..	1s. to 2s. 6d.
Stainland (Halifax)	Independent Sch.	Watts, Rev. L. L.	Haley, Rev. J.	Wilby, R.	..	9	9	..	..	1	..	..	2s.6d. to 3s. ea. subj.
"	Holywell Green M. I.	Shaw, S.	Shaw, S. W.	Shaw, J. Stopford, W. H. Nicholson, R. E.	..	12	12	..	..	3	..	..	2d. per wk.
Stalybridge	Mech. Inst.	Marsland, J.	Smith, D.	Hurst, W.	..	19	19	..	..	5	..	..	2s.
Staveley	*Works Sch.*	*Markham, C.*	*Selby, J.*	*Francis, E.*	..	..	..	..	..	..	..	..	2s.6d. to 5s. ea. subj.
"	*Schoolroom*	*Cottingham, J. E.*	*Macfarlane, Rev. J. D.*	*Craven, J.*	..	..	..	..	..	..	..	..	4s.
Stepney	Red Coat Sch.	Charrington, F.	Scott, W.	Parry, P. Bloomfield, J.	..	20	20	..	..	1	..	..	2s. 6d. ea. subject.
Stepney	*St. Paul's Sch.*	*Cotton, Rev. A. B.*	*Daveney, Rev. T. B.*	*Papworth, F.*	..	..	..	..	..	..	..	..	1s.
"	*Colet Boys' Sch.*	*Valentine, Rev. W.*	*Roe, Rev. J.*	*Jones, T.* *Browne, L.* *Phillips, E. R.*	..	..	..	..	..	..	..	..	Nil.
Stockport	Mech. Inst.	Walthew, J.	Stockdale, R.	Gee, W. Goodwin, J. W. Davies, G. W. Davenport, T.	45	54	9	..	19	8	..	..	2s. 6d. ea. subject.

List of Science Schools, giving the Number of Students, &c.—*continued*.

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
Stockport	Sunday Sch.	Wilkinson, S. W.	Hill, J.	Rathbone, T. H.; Davies, G. W.; Gosling, J. W.	18	34	16	..	5	1	..	..	2*s.* per qr.
Stoke-on-Trent	*Sch. of Art*	*Stamer, Rev. Sir L. P.*	*Keary, W.*	*Bacon, J. P.*	..	..	..	..	..	..	..	..	2*s.* ea. subj.
Stourbridge	Gram. Sch.	Freer, R. L.	Marten, E. B.	Welch, Rev. J. J.; Packer, M. W.; Kennedy, J.	..	16	16	..	..	..	..	..	4*s.* to 10*s.* 6*d.* pr. qr. ea. sub.
Stratford (Essex)	Wkg. Men's Hall	Scott, Rev. T.	Smith, E. E.	Farlie, J. L.; Saunders, J.	58	58	..	..	37	19	..	..	6*s.*
Stratford (Essex)	*Brit. Sch.*	*Angell, L.*	*Taylor, C.*	*Swanson, W.*; *Nankivell, G.*	..	..	..	..	..	..	..	..	5*s.*
Stratford-on-Avon.	*Nat. Sch.*	*Collis, Rev. J. D.*	*Gulliver, Rev. E. H.*	*Burrage, J. W. W.*	..	..	..	..	..	..	..	..	3*s.*
Stroud	Institute	Dickinson, S.	Gardner, H. F.	Smith, P. L.	29	89	60	..	11	4	..	..	1*s.* 6*d.* to 21*s.*
Stroud	*Sch. of Art*	*Winterbotham, R.*	*Dickinson, S. S.*	*Kemp, J.*	..	..	..	..	..	..	..	..	5*s.* per qr. ea. subj.
Sunderland	Monkwearmouth Colliery Sch.	Stobart, W.	Walker, J. E.	Rowden, W. T.; Kerniok, R.; Jack, D.	..	41	41	..	..	..	..	..	5*s.*
Sunderland	*Sch. of Art*	*Burnet, Rev. W. R.*	*Hills, W. H.*	*Thomas, S.*	..	..	..	..	..	..	..	..	1*s.* 6*d.* per month.
,,	*Wkg. Men's College*	*Thompson, W.*	*Wood, P.*	*McLaren, J.*; *Lambton, J. W.*	..	..	..	..	..	..	..	..	5*s.*
Sunninghill (Staines).	*Wes. Day Sch.*	*Portrey, Rev. J.*	*Walker, R.*	*Stokes, J.*	..	..	..	..	..	..	..	..	Nil.
Sutton (Surrey)	*Nat. Sch.*	*Neame, A.*	*Hind, W. L.*	*Knibbs, H.*	..	..	..	..	..	..	..	..	1*d.* and 2*d.* per night.
Sutton Coldfield	*Town Hall*	*Bedford, Rev. W. K. R.*	*Bodington, G. F.*	*Jennings, J. M.*	..	..	..	..	..	..	..	..	1*s.* to 2*s.* 6*d.*
Swansea; ,,	Royal Inst.; Oxford St. Nat. Sch.	Jenkins, J. J.	Williams J.	Smith, A.; Bell, W. G.; Cole, F.; Hosking, H.; Hosford, F. F.; Mollison, A.	45	92	47	..	4	10	..	..	5*s.* to 7*s.* per subj.

Swinton (Manchester).	*Mech. Inst.*	*Heywood, Rev. H. R.*	*Kenyon, N.*	*Stott, H.*	..	..	..	..	..	..	..	..	2s. 6d.
Tavistock	Brit. Sch.	Newland, Rev. J. M.	Luxton, R.	Moffatt, W. Rowe, W. Moffatt, J.	50	81	81	..	22	5	..	1 B.	2s. 6d. ea. subject.
,,	Nat. Sch., Dolvin Rd.	Tancock, Rev. O. J.	Monk, H. E.	Merrifield, J. Rider, A. J. Balkwill, F. P.	..	63	63	..	..	4	..	..	2s. 6d. ea. subject.
,,	Sch. of Art	Tancock, Rev. O. J.	Greenfield, T. W.	Robjohns, F. R.	..	15	15	..	..	2	..	..	2s. 6d. ea. subject.
,,	Duke of Bedford's Sch., Gulworthy	Alford, Rev. D. P.	Philips, W.	Gaud, J. H. Gaud, J. W.	34	68	34	..	9	8	1 B.	..	2s. 6d. ea. subject.
,,	St. Mary Tavy N. S.	Gibbons, Rev. T.	Buller, Rev. A.	Rowe, W.	..	14	14	..	..	..	..	..	1s. ea. class.
Tebworth (Bedfordsh)	Wes. Day Sch.	Seccombe, Rev. W.	Gurney, N.	Mackrell, L.	13	11	..	2	3	..	..	..	1s. 6d. ea. subject.
Thorne (Doncaster).	Brookes' Gram. Sch.	Kenyon, G.	Lister, W.	Constable, J.	17	23	6	..	5	..	..	..	2s. 6d. pr. qr.
Thornton (Bradford).	*Mech. Inst.*	*Craven, J.*	*Wright, T. H.*	*Sugden, W.*	..	..	..	..	..	..	..	..	1s. per qr.
Thrapstone	*Nat. Sch.*	*Bagshaw, Rev. W. S.*	*Goodman, Rev. J. P.*	*Graves, J. J.*	..	..	..	..	..	..	..	..	Nil.
,,	*Brit. Sch.*	*Wilkinson, J. R.*	*Ibbs, C. W.*	*Roe, R. G.*	..	..	..	..	..	..	..	..	1s. 6d.
Toddington (Dunstable).	Nat. Sch.	Cooper, W. C.	Clegg, Rev. J.	Billingham, E.	..	2	2	..	..	..	..	..	2s. 6d.
Toddington	*Wes. Sch.*	*Akehurst, Rev. S. H.*	*Burchell, Rev. W.*	*Roberts, T.*	..	..	..	..	..	..	..	..	1d. per wk.
Todmorden	*Mech Inst.*	*Fielden, J., M.P.*	*Whitehead, J.*	*Kershaw, T.*	..	..	..	..	..	..	..	..	5s. per crse.
Topsham and Woodbury.	*Mut. Imp. Soc. and End. Sch.*	*Davy, D. B.*	*Roberts, W.*	*Sparkes, A. L.*	..	..	..	..	..	..	..	..	6d.
Torquay	Sci. and Art Sch.	Evanson, R. J.	Luxmoore, C. N.	Viccars, T.	63	90	27	..	28	23	1 B.	..	2s. 6d. to 21s. per subj.
Towcester	Nat. Sch.	Hesketh, Sir T. G. F., Bart., M.P.	Lightfoot, Rev. R. P.	Jones, J. C.	..	50	50	..	..	2	..	..	1d. per wk.
Truro	Brit. Sch.	Tweedy, R.	Clyma, G.	Snell, J.	..	17	17	..	..	..	..	..	2s. 6d. ea. subject.
,,	Royal Inst.	Barham, C.	Mayne, J. O.	Collins, J. H.	..	24	24	..	..	..	..	..	5s.
Turton (Bolton)	Chapel Town Inst.	Spencer, Rev. J. O. K.	Isherwood, W.	Stott, H., sen.	..	26	26	..	..	4	..	..	1s. 6d.
Tyldesley (Manchester)	Mech. Inst.	Green, G.	Lomax, W.	Stott, H., jun. Haslam, W.	..	30	30	..	..	8	..	..	Nil.
Ulverstone	Proprietary Sch.	Fell, J.	Sykes, J. S.	Eckersley, H.	18	9	..	9	2	..	..	..	5s. ea. subj.
Wakefield	Industrial and Fine Arts Inst.	Lee, W. H.	Dixon, J. H.	Smith, W. Sturgeon, W.	..	18	18	..	..	4	..	..	5s.
,, ,, ,,	Mech. Inst. Smyth St. Academy Trinity Ch. Sch.	Whitham, S.	,,	Patchett, I. Jefferson, S. Knowles, M.									1s. to 5s.
Walker	*Alkali Works Sch.*	*Thompson, Rev. C.*	*Steele, Rev. J.*	*Bewick, T.*	..	..	..	..	..	..	..	..	2s. 6d. per quarter.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
Wallingford	*Sch.-room, Thames Street.*	*Hawkins, H.*	*Steer, C.*	*Gubb, E.*	..	..	..	..	..	..	..	..	Nil.
Walsall	*Wesley Day Schs.*	*Cox, S.*	*Brocksop, W. H.*	*Smith, D.*; *Smith, A. F.*	..	..	..	..	..	..	..	..	1s. ea. subj.
Watford	*Lit. Inst.*	*Brett, A. T.*	*Wallis, W.*	*Fairman, J. B.*	..	..	..	..	..	..	..	..	9d. per mo.
Wednesbury	*St. John's Schs.*	*Bill, T.*	*Stoney, Rev. R. B.*	*Williams, J.*	..	..	..	..	..	..	..	..	1d. per nt. or 1s. 6d. per crse.
"	*Moxley Nat. Sch.*	*Wilson, Rev. J. P.*	*Pocock, R. R.*	*Williams, J.*	..	..	..	..	..	..	..	..	1d. pr. night.
Weedon	Girls' Sch.	Winter, Rev. J. S.	Williamson, A.	Norman, S. A.	..	42	42	..	..	..	..	..	2s.
Wellingborough	Lower Gram. Sch.	Sherwood, R. W.	Roxby, Rev. H. M.	Winterton, W.; Genner, B.; Percival, W.; Sanders, W. F.	30	52	22	..	12	4	..	..	2s. 6d.
West Bromwich.	St. Peter's Sch.	Jordan, T.	Massey, Rev. C.	Hill, S. T.	..	20	20	..	..	..	..	..	2s. 6d.
Westbury-on-Trym.	Girls' Sch.	Bright, Rev. J. H.	Pease, T.	Gandee, A. G.	..	36	36	..	..	9	..	..	2s. per mo.
West Gorton (Manchester).	St. Mark's N. S.	Connell, Rev. A.	Jackson, T.	Ward, R. P.	..	25	25	..	..	..	..	..	1d. per nt.
Whaleybridge	Spring Bank Chapel	Kirk, J.	Colles, A. H.	Jackson, R.	19	12	..	7	2	1	..	..	3s.
Whitehaven	*Scient. Assoc.*	*Dalton, Rev. M. S.*	*Taylor, B.*	*Tosh, E. G.*; *Kitchen, A.*; *Moon, M. A.*; *Pickering, R.*	..	..	..	..	..	..	..	..	1s. to 2s. 6d. each sub.
Whitworth (Rochdale).	Lit. Inst.	Kay, R. G.	Wolfenden, J.	Sutcliffe, G. W.	..	24	24	..	..	3	..	..	5s.
Wickham Market (Suffolk).	*Nat. Sch.*	*Image, Rev. W. T.*	*Read, C. H.*	*Bales, W. J.*	..	..	..	..	..	..	..	..	3s.
Wigan	Mech. Inst.	Fergie, Rev. T. F.	Peace, M. W.	Botley, R.; Percy, C. M.; Hay, R.	71	91	20	..	17	6	1 B.	..	4s. to 2l. 16s. per subject.
Wilmslow (Cheshire).	*Fulshaw Day Sch.*	*Somerville, T.*	*Jessop, W.*	*Dale, J.*	..	..	..	..	..	..	..	..	2s. per qr.
Wilsden (Bingley).	Mech. Inst.	Clapham, P.	Watmuff, W. G.	Severs, G.	..	11	11	..	..	1	..	..	2s. 6d.
Winchester	*Brit. Sch.*	*Underwood, R.*	*Reynolds, S. P.*	*Barter, W. A.*	..	..	..	..	..	..	..	..	5s. ea. sub.

Windsor	Mech. Inst.	Chamberlain, T.	Lundy, J.	Dorrell, H. B.	..	30	30	..	..	5	..	..	1s. per qr.
Wisbech	Wkg. Men's Inst.	Scott, Rev. J.	Balding, A.	Miller, S. H.	24	40	16	..	7	..	..	..	1s. per qr.
Woburn	*Boy's Sch.*	*Cumberlege, Rev. S. F.*	*Shepherd, Rev. E.*	*Aesbee, J.*	..	..	..	..	..	..	..	..	Nil.
Woking (Surrey)	St. John's Sch.	Wilks, Rev. T. C.	McCormack, R.	Goffin, E. Goffin, Mrs. J.	..	58	58	..	..	..	..	..	4s.
Woking Station	*Com. Sch., Knaphill*	*Brushfield, T. W. G.*	*Radford, J. C.*	*Bushforth, T.*	..	..	..	..	..	..	..	..	2s.6d.pr.qr.
Wolverhampton *Wolverhampton*	St. Peter's Inst. *G. W. Ry. Inst.*	Iles, Rev. J. H.	Langley, J. N.	Horton, F. C. Berry, E. Stanier, W. H. Golby, T.	38	64	26	..	13	3	..	1 S.	1s. 6d. to 5s.
"	St. John's Sch.	Hampton, Rev. H.	Hilliard, Rev. A. B.	Board, G.	4	18	14	..	..	..	..	..	8s. per sess.
Wolverton (Bucks.)	Sci. and Art Inst.	Mumford, A. C.	Meadley, J.	Harnett, Rev. F. W. Nichols, T. Davison, W. Moore, T.	65	83	17	..	18	7	..	..	4s. 6d. per quarter.
Woodville (Burton-on-Trent)	Nat. Sch.	Wilmshurst, Rev. A. T.	Betterton, H. I.	Binns, A.	..	13	13	..	..	2	..	..	4s. per qr.
Woolwich	Roy. Arsl. Sci. Classes	Oram, W. E. S.	Keeble, W. D.	Jones, T. Noble, J. Clarke, J. J. Crowe, J. Jones, E. S. L. Duckett, W. Brittle, J. E. Brown, L. Purnell, J. W.	144	171	27	..	55	42	1 B.	1 B.	2s. 6d. to 10s. per subject.
"	Nat. Sch.	Brown, Rev. H.	Harrison, Rev. F. S.	Farlie, C. J. Wilson, J.	40	55	15	..	33	2	..	..	5s.
"	Presbyterian Schs.	Thompson, Rev. W. M.	Ronald, H.	Jones, T. Browne, L. Courtman, R. J. Downar, W. A. McDougall, H. S. Browne, Mrs.	98	125	27	..	8	1	..	..	Nil.
"	St. Michael's Sch.	Baker, Rev. H. R.	Walter, J. W.	Byatt, H.	15	34	19	..	13	1	..	..	5s.
Worcester	Young Men's Christ. Assoc.	Barnett, R. B.	Day, H.	Ewens, F. T. Pember, J. Cradock, E. W.	71	104	33	..	19	16	..	..	2s.6d.ea.sub.
Worcester	*Trade School*	*Blair, Rev. R. H.*	*Eaton, F.*	*Spencer, J.* *Evans, R.*	..	..	..	..	..	..	..	..	5s. 6d. to 10s. 6d.
"	" *(Evg. Classes)*	"	"	*Spencer, J.*	..	..	..	..	..	..	..	..	4s. ea. sub.
"	*St. John's Sch.*	*Wood, Rev. J. R.*	*James, Rev. J. C.*	*Walker, S.*	..	..	..	..	..	..	..	..	2s.6d.ea.sub.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
Yarmouth, Gt.	Sch. of Navigation and Gram. Sch.	Wolverton, C.	Bracey, J.	Stockton, W.	81	98	17	..	1	1	..	..	6*d.* to 5*s.* per week per subj.
Yarmouth, Gt.	*Sch. of Art*	*Wolverton, C.*	*Cubitt, F. A.*	*Dominy, J. S.*	..	..	..	..	..	..	..	..	2*s.* per mo. each sub.
York	Institute	Palmer, Rev. H. V.	Williams, J.	Proctor, W.; Greenwell, Rev. W.; Robinson, E.; Senior, W. C.	80	51	..	29	6	2	..	..	Nil.
"	Bluecoat Sch.	Richardson, W.	Ford, J.	Robinson, E	..	20	20	..	..	1	..	..	Nil.
"	Training Sch.	Hey, Rev. W.	Bresher, Rev. M. R.	Rowe, Rev. G.	..	16	16	..	..	..	..	..	Nil.
York	*Brit. Sch., Hope St.*	*Rowntree, J.*	*Sessions, W.*	*Pumphrey, W.*; *Thompson, R.*	..	..	..	..	..	..	..	..	Nil.
"	*Sch. of Art*	*Hey, Rev. W.*	*Procter, W.*	*Swallow, J. C.*; *Stephenson, J. F.*	..	..	..	..	..	..	..	..	5*s.* 3*d.* to 31*s.* 6*d.*

SCOTLAND.

Town.	Where held.	Chairman.	Secretary.	Teacher.	1868.	1869.	Increase.	Decrease.	Prizes 1868.	Prizes 1869.	Medals 1868.	Medals 1869.	Fees paid by Students.
Aberdeen	Mech. Inst.	Urquhart, R.	Sinclair, J.	Beveridge, R.; Maver, D.	61	280	219	..	8	2	..	..	6*s.* to 10*s.* per subj.
Alexandria (Ayrsh.)	Mech. Inst.	Ewing, J. O.	Greenlees, W.	Tatlock, R. R.; Millar, W. J.; Andrew, D.	..	90	90	..	..	..	..	..	4*s.* to 9*s.*
Baillieston (Glasgow).	*Crosshill Sch.*	*Ramsay, Rev. H.*	*Dickson, J.*	*Jarvie, P.*	..	..	..	..	..	..	..	..	3*s.*
Banton (Denny).	Public Sch.	McPherson, J.	Walker, J.	Forbes, M. C.	..	17	17	..	..	4	..	..	5*s.*
Beith	New St. Sch.	Muir, W.	Kerr, J.	Cook, W.	7	24	17	..	..	..	..	..	3*s.* 6*d.* per quarter.
Brechin	Free Ch. Sch.-room	Scott, D.	Craig, J.	Cameron, J.	..	31	31	..	..	..	..	..	1*s.* 4*d.* per month.

Corsock (Dalbeattie)	Girls' Sch.	Sturrock, Rev. G.	Currie, R.	Macomish, M.	13	12	..	1	4	..	..	..	1s. each subject. 2s. 6d.
Cults (Aberdeensh.)	Schoolroom	Paul, Rev. W.	Taylor, J.	Summerfield, E.	..	13	13	..	..	2	..	..	
Dingwall	*Academy*	*Davidson, D.*	*Joass, W. C.*	*Boyd, J.*	..	..	..	..	..	..	..	..	5s.
Dumbarton	Burgh Academy	Paul, M.	Babtie, J.	Dickie, H. Anderson, W. Cormack, A.	12	114	102	..	..	6	..	..	10s. each subject.
Dundee	High Sch.	Thoms, W.	Cumming, A. W.	Kennedy, J.	70	90	20	..	6	5	1 G., 1 B.	..	6s. per 3 months.
Edinburgh	Free Ch. Trg. Coll.	Law, W.	Archer, T. C.	MacAdam, S. Lees, W. Pryde, J. Kennedy, W. *Davidson, Dr.*	..	40	40	..	..	13	..	..	
„	Watt Inst. and Sch. of Arts				..	377	377	..	..		..	..	Nil.
Edinburgh	*15, Buccleuch Pl.*				..	..	..	..	..	..	..	..	5s. ea. sub.
„	*Est. Ch. Trg. Coll.*	*Cook, Rev. J.*	*Laurie, S. T.*	*Mackinlay, P.* *Currie, Rev. J.*	..	..	..	..	..	..	..	..	Nil.
Elgin	*New Mill Manuf. and Iron Works*	*Russell, A.*	*Duff, T. D.*	*Pattison, R.* *Russell, T.*	..	..	..	..	..	..	..	..	5s. each subject.
Fortrose (Inverness).	*Mech. Inst.*	*Mackenzie, A. R.*	*Smith, J.*	*Young, Rev. R. C.*	..	..	..	..	..	..	..	..	2s. 6d.
Glasgow	Sec. Sch.	McClelland, J.	Cunliff, R. S.	Mayer, J. Lochore, J. Stone, W. Mayer, Mrs.	80	113	33	..	22	6	..	..	2s. 6d. to 6s. per qr.
„	Anderson's Univy.	Young, J.	Martin, G.	Herschel, A. Buchanan, G. Macadam, S. Laing, A. Hennedy, R.	730	1,013	283	..	33	10	1 B.	..	2s. 6d. per quarter to 21s. per session.
„	Mech. Inst.	Neilson, W. M.	Anderson, J.	Thom, A. H. Moffatt, R. C.	950	500	..	450	7	..	1 S.	..	4s. per 6 months to 6s. 6d. per qr.
„	Est. Ch. Trg. Coll.	Craik, Rev. J.	Snodgrass, G. W.	Dixon, E. M.	..	74	74	..	..	9	..	..	Nil.
Glasgow	*St. George's Sch.*	*Craik, Rev. J.*	*Snodgrass, G. W.*	*Mayer, J.*	..	..	..	..	..	..	..	..	1s.
„	*St. Stephen's Par. Sch.*	*Miller, Rev. T.*	*Watson, T. H.*	*Macaulay, J.*	..	..	..	..	..	..	..	..	1s. to 2s. 6d. per qr.
„	*Port Dundas Sch.*	*Macleod, Rev. D.*	*Ker, W.*	*Mayer, J.*	..	..	..	..	..	..	..	..	1s.
Inverness	Sci. and Art Sch.	Simpson, A.	Galloway, G.	Pratt, R.	27	18	..	9	3	..	..	..	4s. to 6s. per qr.
Inverness	*Royal Academy*	*Thrum, H.*	*Hay, A. P.*	*Duncan, W. S.* *Eadie, W.*	..	..	..	..	..	..	..	..	6s. to 10s. 6d.
Johnstone	*Quarrelton Par. Sch.*	*Donald, J.*	*Malloch, W., jun.*	*Mayer, J.*	..	..	..	..	..	..	..	..	1s. 6d.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
Kilmarnock	East George Street	Dickie, J.	MacKay, J.	Stevenson, J.; Hastie, W.; McCulloch, W.; Neil, J.; Johnston, R.; Dunlop, P.; Gunnyon, Wm.; Grant, T.; Black, F. M.	76	127	51	..	14	..	..	..	2s. 6d. to 5s. ea. sub.
"	Princes Street				..	50	50	..	..	8	..	..	5s. ea. subj.
Kilmarnock	*Sch. of Art*				..	..	..	..	..	..	..	..	Included in Art.
Kirkcaldy	*People's Inst.*	*Swan, P. D.*	*Findlater, J.*	*Aikman, G.*	..	..	..	..	..	..	..	..	3s. to 6s.
Kirkwall	Gram. Sch.	Robertson, J.	Heddle, P. S.	Watson, J.	10	53	43	..	..	..	..	..	2s. 6d. ea. subject
Leith	Navigation Sch.	Watt, J.	Thomson, Rev. J.	Bolam, J.	228	289	61	..	..	1	..	..	1s. 3d. per week, 5s. per course per each subject.
Leith	*St. James' Sch.*	*Blanshard, G.*	*Falconar, Rev. J. S.*	*Jackson, Rev. G.*; *Hodson, S.*	..	..	..	..	..	..	..	..	Nil.
"	*Sch. of Art*	*Watt, J.*	*Thomson, Rev. J.*	*Bain, R. L.*	..	..	..	..	..	..	..	..	2s. per mo.
Lumphanan (Aberdeen).	*Par. Sch.*	*McCombie, Rev. C.*	*Milne, J.*	*Cramond, W.*	..	..	..	..	..	..	..	..	2s. 6d.
Nairn	*Genl. Assemy. Sch.*	*Burns, Rev. J.*	*Wilson, J. H.*	*Dick, J.*	..	..	..	..	..	..	..	..	1s. to 1s. 6d. per mo.
Newhills (Aberdeen).	Stoneywood Sch.	Smith, Rev. J.	Black, G.	Williamson, W. A.	17	30	13	..	..	2	..	..	8s.
Paisley	*George St. Sch.*	*Cowan, H.*	*Martin, F.*	*Mayer, J.*	..	..	..	..	..	..	..	..	1s.
"	*Sch. of Art*	*Murray, D.*	*Hodge, W.*	*Stewart, W.*	..	..	..	..	..	..	..	..	5s. per qr.
Perth	Sch. of Art	Barclay, H.	McNeill, J.	Stevenson, R. J.	..	15	15	..	..	3	..	..	6s. per qr.
Rothesay	*Thomson Inst.*	*Macbeth, D.*	*McEwen, J.*	*Fraser, D. D.*	..	..	..	..	..	..	..	..	3s. 6d.
St. Andrew's	*Madras Coll.*	*Milton, W. T.*	*Lees, G.*	*Brodie, J.*; *Patterson, A.*	..	..	..	..	..	..	..	..	4s. to 6s. per subj.
Stirling	Sch. of Art	Murrie, J.	Shearer, R. S.	Baker, L.	..	18	18	..	..	2	..	..	2s. 6d. per mo. to 6s. per qr.
Tarbat	Parochial Sch.	Campbell, Rev. G.	Mackie, J.	Fraser, Rev. D.	16	41	25	..	1	..	..	..	4s.

IRELAND.

Aghnagar -	*Nat. Sch.* - -	*Crossle, J.* - -	*Clements, M.* -	*Bothwell, T. H.* -	..	..	..	..	..	..	..	..	Nil.
Ahoghill (Ballymena)	„ - -	*Rowan, Rev. R. W.*	*Millar, W.* -	*McIlroy, H.* - *McIlroy, R.* -	..	..	..	..	..	..	..	..	2s. 6d.
Anahilt (co. Down).	School-room - -	Erwin, Rev. R. S. -	Moorhead, Rev. R.	Clements, A. - -	..	19	19	..	..	..	..	..	Nil.
Antrim - - „ - - *Antrim* - -	Main St. N. S. - Male N. S. - - *Ladyhill N. S.* -	Massareene, The Viscount -	Taggart, W. J. -	Bonar, J. - Foley, M. R. - Savage, H. - Stewart, J. -	66	78	12	..	14	3	..	..	2s. 6d. to 4s. per subject.
Ardara (co. Donegal) -	*Female N. S.* -	*Evans, J. M. B.* -	*Brenan, J.* -	*O'Roddy, J.* - *Ward, J. C.* -	..	..	..	..	..	..	..	..	2s. 6d.
Armagh - -	College Street and Gosford Pl. Schs.	McAlister, Rev. J. R.	Osborne, A. T. -	Lee, H. - - McKimm, S. -	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Athlacca (Kilmallock)	*Nat. Sch.* - -	*Synan, E. J., M.P.* -	*Quaid, Rev. D.* -	*Quinn, J.* - -	..	..	..	..	..	..	..	..	Not yet arranged.
Athlone - -	Parochial Sch. -	Handcock, Hon. R. J.	Joly, Rev. J. S.	James, M. H. - -	37	50	13	..	16	3	2 B.	..	Nil.
„ - -	Ranelagh Sch. -	Pidgeon, W. - -	Foster, Rev. R. -	Macintosh, W. T. Quinton, R. F. -	32	36	4	..	35	1	..	..	Nil.
Athlone - -	*Anchors Bower Sch.*	*Maxwell, P.* - -	*Gleeson, E. M.* -	*Finnegan, H.* - -	..	..	..	..	..	..	..	..	Nil.
Athy - -	*Town Hall* - -	*Kynsey, T. B.* - -	*Cross, W. C.* -	*Henderson, J. J.* -	..	..	..	..	..	..	..	..	Total, 80s.
Aughnacloy (co. Tyrone)	*Court House* -	*Scott, W.* - - -	*McKay, W. C.* -	*Wilson, D.* - -	..	..	..	..	..	..	..	..	To be computed.
Bagenalstown (co. Carlow)	Nat. Sch. - -	Hagarty, E. -	Morrin, Rev. P.	Fitzgerald, E. - Cox, J. S. - -	39	53	13	..	7	3	..	..	2s. 6d. ea. subject.
Bailieboro' (co. Cavan)	Mod. Sch. - -	Dalton, G. T. -	Simpson, A. J. -	Doherty, J. J. - -	84	125	41	..	38	20	1 G. 1 S.	..	2s. 6d.
Ballee (co. Antrim).	*Nat. Sch.* - -	*Patrick, J. B.* - -	*Wasson, S.* -	*Hatton, S.* - -	..	..	..	..	..	..	..	..	Nil.
Ballincollig (co. Cork).	„ - -	*Rowntree, G.* - -	*Riorden, D. J.* -	*Reynolds, E.* - -	..	..	..	..	..	..	..	..	Nil.
Ballybay (co. Monaghan)	Nat. Sch. - -	Ffennell, Rev. R., A.B. - - -	McMurray, T. -	Beatty, R. - -	..	16	16	..	..	1	..	..	2s. 6d.
Balleybofey (co. Donegal).	*Town Hall* - -	*Johnston, J. S.* -	*Millar, A.* - -	*Patterson, W.* - -	..	..	..	..	..	..	..	..	2s. 6d.
Ballymena -	Mod. Sch. - -	Rowan, Rev. R. W. -	Wilson, D. M. -	Shannon, A. F. -	18	28	10	..	4	2	..	..	Nil.
„ -	Guy's Nat. Sch. -	Patrick, J. - -	Killen, J. - -	Alexander, J. - -	..	28	28	..	..	1	..	..	2s. 6d.
„ -	Crebilly N. S. -	Kidd, A. - - -	Lynch, Rev. J. -	McCormick, J. -	..	5	5	..	..	..	..	..	2s. 6d.
Ballymena -	*Nat. Sch.* - -	*Kidd, A.* - - -	*Lynch, Rev. J.* -	*Black, R.* - -	..	..	..	..	..	..	..	..	2s. 6d.
„ -	*Harryville N. S.* -	„ - - -	„ -	*O'Neill, A.* - -	..	..	..	..	..	..	..	..	2s. 6d.
Ballymoney (co. Antrim).	Town Hall - -	McElderry, T. - -	McElroy, S. C. -	Elliott, T. - -	..	39	39	..	..	2	..	..	Nil.
Ballynahinch (co. Down).	„ - -	Anketell, W. R. -	Bruce, W. J. -	Priestley, J. R. -	..	29	29	..	..	..	..	..	Nil.
„ -	Alfred St. N. S. -	„ -	„ -	Goodman, J. - -	..	12	12	..	..	..	..	..	2s. 6d.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
Ballyvicknakelly (co. *Down*)	*Nat. Sch.*	*M'Kee, Rev. J.*	*Strain, Rev. J. K.*	*Mackintosh, J.*	..	..	..	..	..	..	..	..	2s. ea. subj.
Ballywalter (co. Down)	Park Sch.	Wilson, Rev. H.	Magill, Rev. D.	McConkey, J. Purse, W.	..	56	56	..	..	..	..	..	2s. 6d. ea. subject.
Ballywilly (co. Armagh)	Nat. Sch.	Irwin, Rev. J.	Keegan, T.	Lee, H. Lee, S.	19	23	4	..	..	..	..	..	2s. 6d.
Balyna	*Nat. Sch.*	*O'Ferrall, A. M.*	*Bourke, C.*	*Traynor, J.*	..	..	..	..	..	..	..	..	Nil.
Bandon	*Allin Inst.*	*Wheeler, J.*	*Eccles, Rev. R. G.*	*Bateman, T.*	..	..	..	..	..	..	..	..	Nil.
Bangor (co. Down).	Endowed Sch.	Binney, Rev. R.	Patteson, Rev. W.	Harvey, I.	..	25	25	..	..	..	..	..	Nil.
Barnesmore (*co. Donegal*).	*Nat. Sch.*	*Pope, R. H.*	*Dunlevy, J.*	*Ward, C. H.*	..	..	..	..	..	..	..	..	2s. 6d.
Belfast	Union Place N. S.	Taylor, D.	Shepherd, W.	Anderson, J.	..	25	25	..	..	..	..	..	5s.
"	May Street	"	"	Cullen, W.	..	..	..	..	..	..	..	..	2s. 6d.
"	Fisherwick Pl. N. S.	"	"	Cleeland, R. Elliott, T.	83	76	..	7	18	6	1 B.	..	5s. ea. subj.
"	Conway St. N. S.	"	"	Kerrigan, J.	..	23	23	..	..	..	..	..	Nil.
Belfast	*New Road St. N. S.*	*Taylor, D.*	*Shepherd, W.*	*Burrowes, Miss C. W.*	..	..	..	..	..	..	..	..	Nil.
"	*Wellington Acad.*	"	"	*Perry, J.* *Whitford, W.*	..	..	..	..	..	..	..	..	7s. 6d.
"	*Victoria Place Sch.*	"	"	*Boal, J.*	..	..	..	..	..	..	..	..	2s. 6d.
"	*Nat. Sch., Townshend St.*	"	"	*Erskine, W.*	..	..	..	..	..	..	..	..	5s.
"	*Northumberland St. Nat. Sch.*	"	"	*Small, H.*	..	..	..	..	..	..	..	..	Nil.
"	*Albion St. N. S.*	"	"	*Dunlop, S.*	..	..	..	..	..	..	..	..	2s. 6d.
"	*Tennent St.*	"	"	*Trodden, P.*	..	..	..	..	..	..	..	..	Nil.
"	*Queen's Bridge N. S.*	"	"	*Brown, R.*	..	..	..	..	..	..	..	..	Nil.
"	*Nat. Sch., Academy St.*	"	*Hanna, Rev. H.*	*Burrowes, Miss C. W.*	..	..	..	..	..	..	..	..	Nil.
Belfast	Model Sch.	Jones, Rev. R. G.	Molloy, J.	Doran, G. Wren, E. Smeeth, R.	141	122	..	19	40	8	..	..	20s. to 50s.

,,	Academy St. N. S.	McCausland, S.	Hanna, Rev. H.	Barbour, S. Campbell, D.	13	20	16	..	7	6	..	..	Nil.
,,	Peoples's Lit. Inst.	Cottar, Rev. W.	Maitland, F. A.	Perry, J. Whitford, W. Small, H.	..	117	117	..	..	3	..	..	9s. per subj.
,,	Brown St. Sch.	Lytle, J.	Johnston, Rev. W.	Donaldson, T. Keatley, W. J.	..	80	80	..	..	2	..	..	Nil.
,,	Nelson St. N. S.	Knox, Rev. R.	Hannah, S.	Bingham, H.	..	14	14	..	..	5	..	..	Nil.
Belfast	*Frederick St. N. S.*	*Guard, Rev. W.*	*Jones, Rev. J. W.*	*Bingham, E.*	..	..	..	..	..	..	..	..	10s. ea. if theydonot come up for exam.
,,	*Linfield Road N. S.*	*McCausland, S.*	*Hanna, Rev. H.*	*Thompson, J.*	..	..	..	..	..	..	..	..	Nil.
,,	*Mercantile Acad.*	*Browne, T. H.*	*Greenlees, Rev. J.*	*Pyper, J.*	..	..	..	..	..	..	..	..	5s.
,,	*Clarence Place Hall*	*Johnston, W. J.*	*Allworthy, E.*	*Cleeland, R.* *Wilson, P.*	..	..	..	..	..	..	..	..	5s. ea. subj.
,,	*Canning St. Acad.*	*Coates, J.*	*Pyper, J.*	*Ledlie, A.*	..	..	..	..	..	..	..	..	Nil.
Beragh (co. *Tyrone*)	*Loan Fund Office*	*Ellis, F.*	*Dixon, Rev. R. V.*	*Martin, W. H.*	..	..	..	..	..	..	..	..	5s.
Bessbrook (Newry).	School-house	Lett, H. W.	Wonfor, W. J.	Sands, T.	21	12	..	9	2	..	..	..	2s. 6d.
Bonecastle (Downpatrick).	*Nat. Sch.*	*Bell, J. H.*	*Bell, J.*	*Nesbitt, J.*	..	..	..	..	..	..	..	..	Nil.
Bornafea (co. *Kilkenny*).	,,	*Kinsella, Rev. B.*	*Lyons, Rev. N.*	*Walshe, J.*	..	..	..	..	..	..	..	..	3s. 6d.
Bruckless (co. *Donegal*).	,,	*Cassidy, S.*	*Kelly, Rev. P.*	*O'Roddy, J.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Bushmills (Coleraine)	,,	*Boyle, Rev. J.*	*Kirkpatrick, Rev. J. G.*	*Elliott, D.*	..	..	..	..	..	..	..	..	2s. 6d.
Caledon (Armagh)	Infant Sch.	Alexander, R.	Armstrong, Rev. W. B.	Wilkin, R. D. Wilson, C. B.	..	17	17	..	..	..	..	..	2s. 6d.
Callan	*Academy*	*O'Keeffe, Rev. R.*	*Sweeny, M.*	*Hawe, W.*	..	..	..	..	..	..	..	..	Nil.
Carlow	Chrn. Sch.	Tyman, M. F.	McGrath, D.	Mayne, A. J.	21	29	8	..	1	4	..	..	2s. 6d. per annum.
Carrickfergus	Mod. Sch.	Birnie, T. M.	Pasley, D.	Stevenson, J. M.	42	59	17	..	16	8	..	..	5s.
Castleblaney	*Annayallo N. S.*	*Wolfe, Ven. J. C.*	*Flanagan, P.*	*Beatty, R. C.* *McAdam, J.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Castlederg (co. Tyrone)	The Edward's Sch.	Edwards, Rev. E.	Crockett, Rev. J.	McGrenahan, W. Colhoun, C.	..	25	25	..	..	..	..	..	Nil.
Castlewellan (co. Down).	*Anneboro' N. S.*	*Shaw, W.*	*Murland, C.*	*Bell, J.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Cloncore (co. Armagh)	Nat. Sch.	Robinson, Rev. G.	Clements, Rev. W.	Carson, R. McNamee, T.	..	8	8	..	..	6	..	..	2s. 6d. ea. subject.
,,	Eglish Nat. Sch.	McVarry, Rev. T.	McNulty, Rev. P.	,,	51	20	..	31	5	..	..	..	2s. 6d. ea. subject.
Clonmel	*Model Sch.*	*Woods, E.*	*O'Hara, T.*	*Stevenson, T.*	..	..	..	..	..	..	..	..	30s. to 32s. 6d. per subj.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
Clonmel	*Sch. of Art*	*Hackett, J.*	*Purcell, P. J.*	*Fraser, E. A.*	..	..	..	..	..	..	..	..	2*s.* 6*d.* to 5*s.*
Coalisland (co. *Tyrone*).	*Infant Sch.*	*Young, Rev. W. J. M.*	*Foster, Rev. J.*	*Campbell, W.*	..	..	..	..	..	..	..	..	Nil.
Coleraine	Mod. Nat. Sch.	Bruce, Sir H. H., M.P.	Bole, W.	Bresland, J.; Cassidy, H.	60	28	..	32	14	5	..	..	2*s.* 6*d.* to 5*s.* per subj.
Comber	Smyth's Nat. Sch.	Rogers, Rev. J.	Rogers, T.	Minniss, J.	96	92	..	4	15	1	..	..	5*s.*
"	Lisbarnet Nat. Sch.	Anderson, Rev. D.	Smiley, W.	Cleland, J. M.									2*s.* 6*d.*
Connor (co. *Antrim*).	*Nat. Sch.*	*Johnston, Rev. W.*	*Lyle, Rev. S.*	*Allen, D.*	..	..	..	..	..	..	..	..	5*s.*
Cooraclare	Nat. Sch.	O'Gorman, N. S.	Meehan, Rev. P.	McDermott, C.	40	71	31	..	14	28	..	..	2*s.* 6*d.*
Cork	Central Model Sch.	Macnamara, Rev. A. D.	-	Latchford, G. D.; Gibson, A.; Dwyer, R.	65	61	..	4	34	4	1 B.	..	Nil.
"	Carmichael Schs.	McOstrich, A.	Magill, Rev. W.	Robinson, J.; " N.	..	78	78	..	..	5	..	..	2*s.* 6*d.*
Cork	*St. Nicholas N. S.*	*Webster, Rev. G.*	*Wilson, Rev. A. B.*	*Crawford, J. B.*	..	..	..	..	..	..	..	..	2*s.* 6*d.* ea. subject.
"	*Sch. of Art*	*Hewitt, T.*	*Duncombe, T. S.*	*Brenan, J.*	..	..	..	..	..	..	..	..	10*s.* per sess.
Cornmeen (co. Monaghan)	Nat. Sch.	Bailey, Rev. W. R.	Fleming, T.	McClean, W.	..	31	31	..	..	..	..	..	2*s.* 6*d.* ea. subject.
Cottown (co. *Down*).	*Nat. Sch.*	*McMinn, A.*	*Clarke, Rev. W.*	*Simpson, J.*	..	..	..	..	..	..	..	..	Nil.
Crossgar (co. *Down*).	*Nat. Sch.*	*Cleland, J.*	*Thomson, Rev. J. G.*	*Wright, J.*	..	..	..	..	..	..	..	..	2*s.* 6*d.*
Cullybackey (*Belfast*)	"	*Patrick, J.*	*Hamilton, Rev. H.*	*Craig, W.*	..	..	..	..	..	..	..	..	8*l.* 15*s.* total sum.
"	*Teesham N. S.*	*Kirkpatrick, Rev. A. T.*	*Gray, Rev. R.*	*Millar, J.*	..	..	..	..	..	..	..	..	2*s.* 6*d.*
Derrygonnelly (co. Fermanagh)	Lisded N. S.	Reade, Rev. L.	McNulty, Rev. T.	Magennis, P.	..	16	16	..	..	..	..	..	2*s.* 6*d.* ea. subject.
Derrylin (co. Fermanagh).	Kinawley N. S.	Benison, J. J.	Winslow, H. M.	Doogan, P.	..	11	11	..	..	1	..	..	2*s.* 6*d.*
Donaghadee (co. Down).	Shore St. N. S.	McMinn, A.	M'Aulay, Rev. J.	Milliken, J.	..	10	10	..	..	7	..	..	Nil.
Donaghadee	*High St. N. S.*	*McMinn, A.*	*M'Aulay, Rev. J.*	*Young, W. J.*	..	..	..	..	..	..	..	..	2*s.* 6*d.* ea. subject.

Donoughmore (co. Down)	Lecture Room	Quinn, Rev. J. C.	Elliott, Rev. J.	Williams, T. M.	..	14	14	..	..	..	..	..	2s. 6d. ea. subject.
Downpatrick	Nat. Sch.	Pilson, C.	Clarke, J.	Fitzpatrick, S.	..	53	53	..	..	1	..	..	2s. 6d.
Drogheda	St. Mary's Inst.	Mathews, Rev. T.	McGreevy, N.	Dolan, J.	20	31	2	..	2	7	..	..	4d.
Dromara (co. Down)	*Court House*	*Craig, Rev. W.*	*Patton, Rev. W. J.*	*Mackintosh, J.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Dromore (Tyrone).	*Corbally N. S.*	*Simpson, Rev. S. H.*	*McKenna, Rev. E.*	*Donnelly, T.*	..	..	..	..	..	..	..	..	Nil.
Drumavish (co. Donegal).	*Nat. Sch.*	*Johnston, J.*	*Johnston, J.*	*Patterson, W.*	..	..	..	..	..	..	..	..	1s.
Drumlough (co. Down)	*Nat. Sch.*	*Chambers, J.*	*McClelland, Rev. J.*	*Mackintosh, J.*	..	12	12	..	..	2	..	..	2s. 6d.
Dublin	Central Model Sch.	Newell, W. H.	Butler, E.	Joyce, P. W. Smeeth, J. F.	127	213	86	..	31	7	..	..	Nil.
Dublin	*Wes. Sch., George's St. South.*	*Sibthorpe, J.*	*Ker, Rev. J.*	*Marshall, J.*	..	..	..	..	..	..	..	..	Nil.
"	*Young Men's Chr. Assoc.*	*Stanford, Rev. C. S.*	*Gibson, Rev. B.*	*Scott, J. M.*	..	..	..	..	..	..	..	..	Nil.
"	55, *Aungier St.*	*West, Very Rev. J.*	*Hackett, Rev. J. W.*	*Anderson, D.*	..	..	..	..	..	..	..	..	Nil.
Dundalk " " "	Free Library Quay St. Sch. Educl. Inst. Jocelyn St. Sch.	Neville, J.	Hesse, J.	Lyons, Michael McEwen, Hugh Leonard, T. Armstrong, G. Turner, J. W. McLoughlin, J. S.	62	90	28	..	52	52	1 G.	1 B.	3s. ea. sub.
Dundrod (co. Antrim).	*Nat. Sch.*	*Magill, Rev. W.*	*Sinclair, R.*	*Wallace, R.*	..	..	..	..	..	..	..	..	Nil.
Dundrum (co. Down).	*Endowed Sch.*	*Cuppage, Rev. A.*	*Napier, Rev. W.*	*Ringland, J.*	..	..	..	..	..	..	..	..	5s.
Dungannon	Society's House	Newton, C.	Gaussen, Rev. E. J.	Orr, J.	..	29	29	..	..	..	..	..	Nil.
Dungiven (co. Londonderry).	*Nat. Sch.*	*Mooney, Rev. D.*	*Morrison, R.*	*McKinty, C.*	..	..	..	..	..	..	..	..	2s. 6d.
Dunmanway	*Model Sch.*	*Bryan, J. H.*	*Hungerford, H. J.*	*Donovan, D.*	..	..	..	..	..	..	..	..	Nil.
"	*Reenoscrena, N. S.*	"	"	"	..	..	..	..	..	..	..	..	Nil.
Ederney (co. Monaghan).	*Moneyvrice and Agahagaffart N. S.*	*O'Reilly, Rev. J.*	*McGough, Rev. E.*	*Donnelly, T.*	..	..	..	..	..	..	..	..	Nil.
Enniskillen	Model Nat. Sch.	Greer, Rev. S.	Bagot, E.	Morris, C.	..	39	39	..	..	..	..	..	2s. 6d. to 5s.
Enniskillen	*Rossdoney Nat. Sch.*	*Rudd, Rev. T.*	*Carroll, Rev. P.*	*Doogan, P.*	..	..	..	..	..	..	..	..	2s. 6d.
Galway	Model Sch.	Persse, T. M.	Gordon, J.	Moylan, J.	43	51	8	..	5	..	..	..	Nil.
Gilford	Mill Sch.	M'Master, J. W.	Whiteside, T. R.	Martin, H.	35	49	14	..	8	2	..	..	Nil.
Grange O'Neil-land.	*Parochial Sch.*	*Ard, Rev. A. J.*	*Irwin, Rev. A.*	*Baile, R.*	..	..	..	..	..	..	..	..	Nil.
Greyabbey (co. Down).	Nat. Sch.	Montgomery, H.	Hall, Rev. W.	Walker, W.	..	49	49	..	..	..	..	..	Nil.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
Hillsborough	*Boys' Sch.*	*Gibbs, Ven. J. A.*	*Phipps, Rev. O. H.*	*Read, J.*	..	..	..	..	..	..	..	..	Nil.
Holywood	Sullivan Sch.	Hunter, J.	Foster, A. F.	Speers, A. Jenkinson, E. Waterworth, H.	76	117	41	..	18	7	..	..	Nil.
Kilkee (co. *Clare*).	*Nat. Sch.*	*Moore, J. W.*	*McDonnell, M.*	*Devine, M. J.*	..	..	..	..	..	..	..	..	2s. 6d. to 5s.
Kilkenny	Model Sch.	Blunden, Sir J., Bart.	Montmorency, Rev. W. de.	Ryan, L. J.	46	44	..	2	9	1	..	..	2s. 6d. ea. subject.
Kilkenny "	*Model Farm Sch.* *Pocock Inst.*	*Blunden, Sir J., Bart.*	*Montmorency Rev. W. de.*	*Ryan, L. J.* *Deverill, R.*	..	..	..	..	..	..	..	..	2s. 6d.
Killinchy (co. *Down*).	*School-house*	*Ward, Rev. H.*	*Boomer, Rev. C. C.*	*Cleland, J. M.*	..	..	..	..	..	..	..	..	2s. 6d.
Killybegs (co. *Donegal*).	*Nat. Sch.*	*Barrett, W.*	*Rogers, C.*	*Ward, J. C.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Killylea (co. Armagh)	School-house	Cross, W.	Ellis, Rev. T.	Brownlee, T. Gibson, J. W. Anderson, J. P.	..	43	43	..	..	1	..	..	2s. 6d.
Kilmihil (co. *Clare*).	*Leitrim Nat. Sch.*	*Browne, E. B.*	*Moloney, Rev. M.*	*O'Callaghan, P.*	..	..	..	..	..	..	..	..	2s.6d. per qr.
Kilmore (co. Armagh).	School-house	Irwin, Rev. C. K.	Paton, Rev. J.	Baile, R.	..	18	18	..	..	..	..	..	Nil.
Kircubbin (co. Down).	Nat. School-house	Lyle, Rev. E. A.	Rowan, Rev. J.	Walker, W.	..	14	14	..	..	..	..	..	Nil.
Kircubbin	*Glastry N. S.*	*Gilchrist, Rev. J.*	*Hawthorne, Rev. S.*	*McConkey, J.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Larne	Model Agric. Sch.	Porter, Rev. C.	Eccles, W.	Hay, W.	40	30	..	10	15	3	..	1 B.	5s.
Larne and Inver.	*Nat. Sch.*	"	"	*Davidson, J. G.*	..	..	..	..	..	..	..	..	5s.
Letterkenny	Nat. Sch.	Gallagher, J.	Kelly, Rev. B.	O'Donnel, H. M'Fadden, E.	19	34	34	..	..	1	..	..	5s. ea. sub.
Ligoniel (near Belfast).	Wolfhill Mill N. S.	Montgomery, J.	Orr, W.	Barbour, S.	..	27	8	..	5	12	..	1 B.	Nil.
Limerick	*Sch. of Art*	*Spillane, W.*	*Connihan, J.*	*Brophy, N. A.*	..	..	..	..	..	..	..	..	1s. to 2s. pr. month.
Lisnagry (co. Limerick).	Ahane N. S.	Powell, C.	Bourke, R.	Carey, J.	..	20	20	..	..	..	..	..	2s. 6d.

Londonderry	District Model Sch.	Smyth, Rev. R.	Dugan, C. W.	Gleeson, P. V.	..	41	41	..	..	..	..	..	25s.
Londonderry	*Gwyn's Char. Inst.*	*Darcus, H.*	*Skipton, P.*	*Cotter, E. G.*	..	..	..	..	..	..	..	..	Nil.
Lough Cutra (co. Galway).	Nat. Sch.	Gough, The Rt. Hon. Viscount.	Watson, J.	Cusack, M.	..	4	4	..	..	..	..	..	8s. per ann.
Lurgan " "	Mech. Inst. Mod. Sch. Nat. Sch.	Hancock, J.	Magahan, F. W.	Porter, G. Galway, W. J. English, W.	61	104	43	..	18	2	..	..	5s. ea. sub.
Macroom (co. Cork)	*Nat. Sch.*	*Crooke, W.*	*Strong, T. K.*	*Carroll, J.*	..	..	..	..	..	..	..	..	Not yet arranged.
Magherafelt (co. Londonderry).	*Nat. Sch., No. 2*	*Montgomery, Rev. A.*	*McFall, A.*	*McMurray, S.*	..	..	..	..	..	..	..	..	Nil.
Manorhamilton	Court House	O'Donnell, J.	Shaw, S.	Birney, J.	..	80	80	..	..	..	..	..	2s. 6d.
Markethill	Coolmalish N. S.	O'Toole, Rev. D.	Cuming, Rev. W.	Nugent, F.	20	13	..	7	4	..	..	..	2s. 6d.
Millisle (co. Down).	*Nat. Sch.*	*Carmichael, D.*	*McAuley, Rev. J.*	*Simpson, M.*	..	..	..	..	..	..	..	..	2s. 6d.
Millstreet (co. Cork).	*Nat. Sch.*	*Leader, J.*	*Cronin, J. B.*	*O'Connor, T. M.*	..	..	..	..	..	..	..	..	Nil.
"	Cullin N. S.	"	"	"	..	..	..	..	..	..	..	..	Nil.
Moira (co. Down)	Brookfield Agric. S.	Richardson, J. J.	Swann, T.	Davidson, W. Pedlow, G.	..	23	23	..	..	..	..	..	Nil.
Monaghan	Model Sch.	Lloyd, J.	Hardley, F.	Lineham, P.	..	102	102	..	..	10	..	..	2s. 6d. ea. subject.
Monaghan	*Aghnalogh Nat. Sch.*	*Reilly, J.*	*O'Neill, Rev. S. J.*	*Macklin, J.*	..	..	..	..	..	..	..	..	2s. 6d.
"	*Corcaghan N. S.*	*McKenna, Rev. J.*	*Smyth, P.*	*Brennan, E.*	..	..	..	..	..	..	..	..	10s.
Moy (co. Tyrone).	*Nat. Sch.*	*Coyne, Rev. M.*	*Bradley, Rev. M.*	*Kelly, P.*	..	..	..	..	..	..	..	..	Nil.
Moyasta	*Kilrush N. S.*	*Burkitt, Rev. G.*	*Sheedy, T.*	*Burke, J.*	..	..	..	..	..	..	..	..	1s. per mo.
Mullinavatt	*Class Room*	*Hoare, Very Rev. E. N.*	*Cavet, J.*	*Cane, J. B. N.*	..	..	..	..	..	..	..	..	Nil.
Newry	Model Sch.	Dodd, Rev. J.	Porter, D. C.	Watt, W. D. O'Brien, P. T.	41	16	..	25	..	..	..	..	5s.
Newry	*Cloughoge N. S.*	*Murphy, Rev. M.*	*Donnelly, Rev. J.*	*Nugent, F.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Newtownards "	Model School East St., No. 2, N. S.	Pooler, Rev. J. G. Moore, Rev. H.	Macdonnell, J.	Harbison, M. Greer, W. H. O'Reilly, J. C.	134	148	14	..	50	..	1 G., 1 S., 1 B.	..	Nil.
				McConkey, J. Young, W. J.	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
"	Ballyblack Sch.	Parke, Rev. D.	Mitchell, Rev. W.	Anderson, J.	..	13	13	..	..	..	..	..	Nil.
Newtownards	*Loughriescouse N. S.*	*Macaulay, Rev. M.*	*Macdonnell, J.*	*Anderson, J.*	..	..	..	..	..	..	..	..	Nil.
Newtownbreda	Nat. Sch.	Kennedy, J.	Anderson, Rev. W.	Erwin, M.	33	29	..	4	..	..	..	..	2s. 6d.
Newtownlimavady	*Town Hall*	*Cather, W.*	*Brown, Rev. N. M.*	*Speers, R.*	..	..	..	..	..	..	..	..	2s. 6d. to 10s. ea. sub.
Newtownstewart.	*Model Sch.*	*MacIvor, Rev. J.*	*Gordon, F.*	*Dowling, F. M.*	..	..	..	..	..	..	..	..	2s. 6d.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
Newtown-stewart.	*Lower Langfield N.S.*	*Kennedy, Rev. H.*	*Stack, Rev. T. L.*	*Clements, W. T.*	..	..	..	..	..	..	..	..	Nil.
Oldcastle	Endowed Sch.	Durdin, Rev. T. G.	O'Neill, R.	Beatty, J.; Smyth, A.	190	201	11	..	26	40	1 S., 1 B.	1 S.	Nil.
Omagh	Model Sch.	Byrne, Rev. J.	Chartres, Rev. W.	Ferguson, S. H.	..	46	46	..	..	11	..	..	5s. returned at exn.
Parsonstown; *Parsonstown*	"; *Y. M. Chr. Assoc.*	Rt. Hon. the Earl of Rosse	Brown, S.	McManus, Wm.; Hetherington, G.; O'Brien, M. H.	..	25	25	..	..	5	..	..	Nil.
Portadown; *Portadown*	Edenderry N. S.; *Baptist Meeting House.*	Armstrong, T.	Wallace, H.	Baile, R.; Martin, H.; Forbes, J.	..	18	18	..	..	1	..	..	Nil.
"	*Temp. Hall*	*Shinnamore, T. W.*	*Waugh, D. W.*	*Lee, H.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Portaferry	*Nat. Sch.*	*Filson, A.*	*Orr, Rev. J.*	*Doyle, P.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Portaferry (co. Down)	*Nat. Sch., No. 2*	"	"	*Begley, G. B.*	..	..	..	..	..	..	..	..	2s. 6d. for each class.
Ramelton (Letterkenny).	*Robertson's N. S.*	*Gwynn, Rev. J.*	*Mitchell, M.*	*Coyle, D.*	..	..	..	..	..	..	..	..	Nil.
Raphoe (co. Donegal).	Nat. Sch.	Weir, Rev. J. A.	Morrow, H.	Cotter, E. G.	18	6	..	12	10	..	..	..	Nil.
"	*Convoy Concert Hall*	"	"	*McCaffery, W.*	..	..	..	..	..	..	..	..	Nil.
Rathfryland	Town Hall	Smyth, Rev. E.	Meek, B. B.	Williams, T. M.	..	17	17	..	..	..	..	..	2s. 6d. ea. subject.
Rich Hill	*Ballynahinch N. S.*	*Skuse, Rev. C.*	*McCaldin, Rev. A.*	*Baile, R.*	..	..	..	..	..	..	..	..	Nil.
Roscrea (co. Tipperary)	Nat. Sch.	Meagher, Rev. J.	Somers, J. L.	McGrenahan, E.; Kelly, T.	9	34	25	..	7	5	..	..	5s. each subject.
Roslea	*Greaghawarren and Deerpark Nat. Sch.*	*McKenna, Rev. J. J.*	*Keenan, J. B.*	*Cassidy, J.*	..	..	..	..	..	..	..	..	2s. 6d.
Rosscarbery (co. Cork).	Mt. Fachnanus N. S.	Lucey, Rev. J.	Mulcahy, Rev. J.	Prendergast, P.	..	40	40	..	..	..	..	..	Nil.
Santry	Trg. Inst.	West, Very Rev. J.	Hackett, Rev. J. W.	Hill, J.; Smith, R.; Shekelton, W.	60	91	31	..	27	4	1 S., 3 B.	..	Nil.
Scariff	Nat. Sch.	Hampson, F. C.	O'Mally, P.	O'Gorman, T.	..	38	38	..	..	..	..	..	2s. 6d. ea. subject.

Sixmilecross (Omagh).	"	Mann, D.	Junk, Rev. T. W.	Crooks, S.	..	21	21	..	..	1	..	..	Nil.
Skibbereen (co. Cork).	*Nat. Sch.*	*Davis, Rev. C.*	*Shea, J.*	*Prendergast, P.*	..	..	..	..	..	..	..	..	Nil.
Sligo	*St. John's N. S.*	*Kidd, J.*	*Dowden, Rev. J.*	*Fawcett, J.*	..	..	..	..	..	..	..	..	2*s.* 6*d.* per month.
Stewartstown (co. Tyrone).	No. 2 Nat. Sch.	McCurdy, Rev. S.	Harkness, Rev. J. N.	Campbell, W.	..	24	24	..	..	..	..	..	Nil.
Strabane (co. Tyrone).	*Town Hall*	*White, O.*	*Leney, A.*	*Patterson, W.*	..	..	..	..	..	..	..	..	2*s.* 6*d.* to 10*s.*
"	*Par. Sch., Church St.*	"	"	*Matthews, C.*	..	..	..	..	..	..	..	..	2*s.* 6*d.*
Strabane	*Tullywhisker Sch.*	*Seymour, Rev. C.*	*McConaghey, Rev. J.*	*Colhoun, C.*	..	..	..	..	..	..	..	..	Nil.
Templepatrick (co. Antrim).	*Lylehill N. S.*	*Hamilton, Rev. H. M.*	*Black, Rev. J.*	*Stronge, J.*	..	..	..	..	..	..	..	..	1*s.* 6*d.*
Trim	Model Sch.	Lightburne, H.	Conwell, E. A.	Freehill, M.	62	96	34	..	28	7	..	..	Nil.
Tulla (co. Clare)	*Nat. Sch.*	*O'Callaghan, C. G.*	*O'Donovan, Rev. M.*	*O'Brien, J.*	..	..	..	..	..	..	..	..	2*s.* 6*d.* per quarter.
Tullamore	*Charleville Sch.*	*Pierce, T. H.*	*Craig, Rev. G.*	*Bateman, T.*	..	..	..	..	..	..	..	..	Nil.
Waterford	Model Sch.	Hoare, Very Rev. E. N.	Cavet, J.	Dowling, J. Garnett, E.	55	34	..	21	8	2	..	..	5*s.* to 7*s.* 6*d.* ea. subj.
"	Newtown Sch.	"	"	Cane, J. B. N.	..	43	43	..	..	..	..	..	Nil.
					11,925	21,669	9744	—	3,245	1,854			

TABLE II.

15. TABLE showing the CLASSES in each of the preceding SCIENCE SCHOOLS, the SUBJECTS taught, and the NUMBER of STUDENTS in each Subject. March 1870.

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
	ENGLAND.																								
Abingdon	British School	50	..	..	..	..	..	..	..	..	6	16	..	..	..	26	..	..	..	..	..	..	..	..	2
Accrington	Mechanics' Institution	50	6	19	13	25	..	..	..	3	6	14	..	..	..	7	..	..	..	..	..	..	..	..	15
"	25, Bridge Street	10	..	..	..	..	..	..	..	..	10	10	..	..	..	10	..	..	..	..	..	..	..	..	..
"	Christ Church National School.	10	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..
Alderley Edge	Reading Room and Library	7	4	4	4	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Almondbury	Grammar School	17	..	..	..	10	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..
Alnwick	Mechanics' Institution	12	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8
Andover	Grammar School	30	..	..	..	..	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	30
Armley	Church School	1	..	..	..	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ashby-de-la-Zouch	Mutual Improvement Society	34	..	..	..	..	..	..	..	..	16	21	..	..	..	..	..	..	8	..	..	..	..	..	..
Ashton-under-Lyne	Mechanics' Institution	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Michael's Young Men's Christian Association.	45	13	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	45
"	Hurst Mech. Institution	10	10	10	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Dukinfield Village Library	16	..	..	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..
"	Dukinfield Old Chapel Sunday School.	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bacup	Mechanics' Institution	45	19	19	19	..	..	..	12	..	..	16	..	..	..	14	..	..	..	..	..	..	..	..	..
"	Wesleyan Day School	40	..	..	..	..	..	..	..	..	..	..	..	..	..	40	..	..	..	..	..	..	..	..	..
Backworth	Old Chapel	30	30	30	30	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Balham	Working Men's Institution	14	14	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Banbury	British School	18	..	..	..	8	..	6	..	16	..	..	..	..	..	12	10	..	..	..	..	..	..	..	..
"	Mechanics' Institution	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..
Bangor	Normal College	30	..	..	..	25	..	25	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..
Banstead	School-room	33	..	..	..	..	..	..	..	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	27

Barnard Castle	Mechanics' Institution	23	..	13	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..
Barnsley	Mechanics' Institution	12	8	..	..	..	..	..	..	6	4	..	..	..	..	..	..	..	..	..	..	..	..	..
Barnstaple	Literary and Scientific Institution.	65	..	..	..	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15
Bath	Weston Boys' School	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16
"	St. Mark's National School, Lyncombe.	21	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..	21
Batley	Mechanics' Institution	18	6	..	..	..	..	..	..	..	14	17	..	..	..	..	..	..	..	..	..	..	..	..
"	Independent School	20	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..
Beccles	Leman School-room	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7
Bedlington	Colliery School	27	27	27	27	..	..	..	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bedford	Commercial School	23	..	..	..	..	..	..	..	..	..	..	..	..	..	23	..	..	..	..	..	..	..	18
Berkeley	Church of England School	15	..	..	..	..	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..
Bingley	Mechanics' Institution	13	..	..	..	..	..	..	..	5	6	10	..	..	..	..	..	..	..	..	..	..	..	..
Birkenhead	School of Art	30	20	8	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Hamilton School	15	..	..	..	..	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..
Birmingham	Midland Institute	194	11	..	..	..	..	..	..	21	..	152	..	..	..	8	..	13	..	..	..	..	..	52
"	School of Art	82	22	54	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Clarendon Chambers	38	..	14	16	..	..	..	..	10	15	..	..	..	..	3	..	..	..	..	..	..	..	..
"	Bloomsbury Institution	60	9	20	12	..	..	..	..	5	5	5	..	5	..	16	..	..	..	..	..	..	..	22
"	Graham Street Institution	22	..	..	..	..	..	..	..	14	14	..	..	..	..	11	..	..	..	..	..	..	..	7
"	Church of the Saviour School.	13	..	..	..	..	..	..	..	13	13	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. George's School	28	..	..	..	..	..	..	..	..	..	..	..	27	..	..	..	..	..	..	..	..	..	24
"	St. Paul's School	91	..	34	19	..	..	..	..	..	49	54	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Mary's School	35	..	15	15	..	..	..	..	9	9	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Mark's School	41	..	15	15	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	32
"	St. Clement's School	18	..	..	..	..	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	18
"	Deritend Working Men's Association.	22	12	..	..	14	..	..	..	7	15	..	..	..	..	12	..	..	..	..	..	..	..	..
"	New Jerusalem School	9	..	..	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..
"	Middle Class School	48	12	12	12	..	..	..	..	..	..	44	..	..	..	..	..	..	..	..	..	..	..	..
"	Bishop Ryder's School	17	14	..	..	7	..	..	..	..	..	17	..	..	..	14	..	..	..	..	..	..	..	..
"	Blue Coat School	18	..	..	..	..	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..
"	Wesleyan School	10	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..
"	Friends' Bible Association	19	..	..	..	..	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..
"	Trade School	30	..	..	..	..	..	..	..	..	30	..	..	..	..	30	..	..	..	..	..	..	..	..
"	St. Matthias' School	27	..	..	..	..	..	..	..	..	23	..	..	..	..	26	..	..	..	..	..	..	..	..
"	Steelhouse Lane School	20	..	..	..	..	..	..	..	..	20	..	..	..	..	20	..	..	..	..	..	..	..	..
"	Mutual Improvement Society	16	..	..	..	..	..	..	..	..	31	30	..	..	..	..	..	..	..	..	..	..	..	..
Birstall	Mechanics' Institution	29	..	..	..	..	..	..	..	28	22	21	..	..	..	..	..	..	..	..	..	..	..	28
Bishop Auckland	Wesleyan School	35	..	..	..	..	..	..	..	..	..	35	..	..	..	..	..	..	..	..	..	..	..	..
Bishop's Stortford	Literary Institution	10	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Blackburn	Wesleyan School	54	..	..	..	..	..	..	..	9	13	23	..	..	..	40	..	..	..	..	..	..	..	24
"	Church Institution	13	..	..	..	..	..	..	..	12	..	..	..	..	..	12	..	..	..	..	..	..	..	..
"	Town Hall	8	8	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Blackley	Assembly Rooms	24	24	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Blyth	National School	15	15	15	15	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bodmin	Literary Institution	21	..	..	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	5
Bolton	Science and Art School	120	30	30	30	10	..	15	15	12	12	35	..	6	..	40	..	..	..	..	..	..	..	5	25
"	Mechanics' Institution	70	60	55	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Dean Mills B. S.	15	15	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Unitarian School	11	..	..	..	..	..	..	..	..	11	..	..	..	..	10	..	..	..	..	..	..	..	..	..
Boston	National Schools	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9	..	..	16
"	School of Art	16	3	14	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bradford	Mechanics' Institution	27	..	..	..	..	..	..	..	..	15	20	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Builder's Technical School	19	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Hallfield School	15	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Wesleyan School	18	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..
Bramley	Grove House	13	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..
Breage	Literary Institution }	17	..	..	..	..	..	..	..	..	..	17	..	8	17	..	..	..	..	..	..	..	..	..	..
"	Germoe National School }																								
Bredbury	St. Mark's National School	64	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	64
Bridport	Literary and Scientific Institution.	7	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Brigstock	Farming Woods' School	30	..	..	..	..	..	..	..	5	20	..	..	..	..	30	..	..	..	..	..	..	..	..	..
Brington	National School	9	..	..	..	7	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bristol	Trade and Mining School	256	107	110	95	85	..	55	55	19	74	118	87	..	..	..	..	19	19	6	..	..	..	..	..
"	Young Men's Christian Association.	93	10	10	..	..	..	..	..	8	6	21	21	10	..	66	..	..	..	..	..	..	..	..	..
"	Wesleyan School	50	50	..	50	..	..	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..
Brixham	British School	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..
Bromsgrove	Literary and Mechanics' Institution.	26	..	..	..	..	..	..	..	..	..	26	..	..	..	25	..	..	..	..	..	..	..	..	..
Burnley	Literary Institution	53	..	31	32	..	..	..	12	..	..	8	..	..	..	6	..	3	..	..	..	..	..	..	..

"	Carlton Road School	55	..	..	..	..	..	..	..	..	..	55	..	..	..	20	..	..	..	..	..	..	..	..	..
"	Mechanics' Institution	69	20	45	45	..	..	..	4	..	..	6	..	..	..	34	..	..	..	..	..	..	..	..	6
"	Grammar School	40	..	..	..	20	..	..	..	..	..	40	..	20	..	..	..	..	..	..	..	..	..	..	..
"	St. Peter's School (Schoolmaster's Class).	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Burslem	Wedgwood Institution	48	8	8	8	..	..	..	..	..	..	40	..	..	..	..	..	..	..	..	..	..	..	..	..
Bury	Athenæum	55	55	50	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Caistor	Lower Grammar School	22	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	18
Calverley	Mechanics' Institution	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Camborne	Literary Institution	15	..	..	..	..	..	..	..	..	..	15	..	..	15	..	..	..	..	..	..	..	..	..	..
Canning Town	Holy Trinity School	24	24	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cardiff	Free Library	40	12	18	18	19	..	12	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Carharrack	Literary Institution	17	..	..	..	..	..	..	..	..	..	17	..	..	17	..	..	..	..	..	..	..	..	..	..
Carmarthen	Training College	30	..	..	..	30	..	30	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30
Charlesworth	Mechanics' Institution	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Charlton, New	Mathematical Instrument Works' School.	22	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chatham	St. Mary's School	34	32	33	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Mark's, New Brompton	28	24	24	{23 5*}	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cheltenham	Training College	60	..	..	..	60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	60
"	{Young Men's Christian Association / British School}	56	..	..	..	..	..	..	..	..	..	..	..	..	..	56	..	..	..	..	..	..	..	..	..
"	Whitworth School	212	..	..	..	13	..	5	5	24	173	24	24	35	..	56	13	19	..	..	7	..	..	..	9
Chester	School of Science and Art	26	20	15	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chesterfield	National School	21	18	18	8	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chorley	St. George's National School	10	5	10	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Church	National School	47	..	..	..	..	..	..	..	..	19	40	..	..	..	45	..	..	..	..	..	..	..	..	..
Cirencester	School of Art	12	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Clay Cross	Public Hall	53	50	30	20	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Coalbrookdale	Literary and Scientific Institution.	26	26	15	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Colne	Grammar School	16	..	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Compstall	Athenæum	30	14	14	14	..	..	..	..	..	..	10	..	..	..	16	..	..	..	..	..	..	..	..	..
Cottesmore	National School	16	..	..	..	..	..	..	..	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Coventry	St. Peter's National School	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	22
Crawshawbooth	Mechanics' Institution	23	23	23	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Crewe	Mechanics' Institution	26	25	26	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Croydon	Literary Institution	16	15	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Andrew's National School.	8	8	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Culham	Training College	20	16	..	..	16	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	20
Dartmouth	National School	24	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

* Naval Architecture.

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Darwen	Mechanics' Institution	28	28	28	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Daventry	Grammar School	20	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Deptford	St. Paul's School	65	37	37	37	34	..	34	33	..	..	..	..	..	..	..	..	..	..	..	..	..	..	33	..
"	St. John's School } St. John's Mission Hall }	14	14	..	..	9	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8	..
Derby	Grammar School	7	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..
Devonport	Mechanics' Institution	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	5	..	..	..	..	..	..
"	14, St. Aubyn Street*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dewsbury	Mechanics' Institution	58	14	..	..	..	..	..	..	11	11	11	11	..	..	..	..	..	..	..	..	..	..	..	..
"	Wesleyan Literary Society	8	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..
Doncaster	Guildhall	23	23	13	11	4	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Great Northern Railway School.	60	..	60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Droitwich	National School	30	..	..	..	..	..	..	..	..	..	25	..	..	..	30	..	..	..	..	..	..	..	..	..
Droylsden	Educational Institution	40	32	32	32	..	..	..	..	..	..	15	15	..	..	..	..	..	..	..	..	..	..	..	..
Dudley	Mechanics' Institution	28	10	9	2	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Blue Coat School	48	..	..	..	..	..	..	..	..	..	48	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Netherton National School	18	..	..	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	13
Dunstable	Ashton School	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30
Eagley	Institute	18	..	..	..	..	..	..	..	..	..	2	..	..	..	18	..	..	..	..	..	..	..	..	..
Earlestown	Infant School	20	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	London and North-Western Railway Library and Reading Room.	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Eastington	National School	10	..	10	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Eastwood	Mechanics' Institution	18	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Eccleshill	Mechanics' Institution	10	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..
Elland	National School	16	16	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Elsecar - -	National School - -	21	..	..	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..
Erith - -	National School - -	19	19	91	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Evesham - -	Bengeworth, Deacle's School	19	..	..	..	..	..	..	..	..	9	..	..	..	..	18	..	..	..	..	..	..	..	..
Exeter - -	Albert Memorial Institution	56	..	..	..	13	..	..	..	..	..	18	..	24	..	8	..	12	12	..	..	..	..	..
Failsworth - -	Mechanics' Institution -	29	29	29	29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Farnworth - -	Grammar School - -	36	36	24	24	20	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	Wesleyan School - -	58	58	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	St. James' School, Newbury	22	..	..	..	..	..	10	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..
„ - -	Halshaw Moor School -	15	15	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Faversham - -	Institute - - -	29	..	..	..	..	..	..	..	..	..	12	..	..	..	25	..	..	..	..	..	..	..	..
Finedon - -	Temperance Hall - -	32	..	..	..	..	..	..	..	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Frampton-on-Severn	National School - -	7	..	..	7	..	..	..	..	..	..	..	..	7	..	7	..	..	..	..	..	..	..	..
Friezland - -	Christ Church Institution -	17	17	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Frome - -	School of Art - - -	20	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	Blue Coat School - -	22	..	..	..	..	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Garforth - -	Working Men's Club -	7	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..
Gateshead - -	National School - -	40	30	30	30	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	30	..
„ - -	Boys' Schoolroom, Felling Chemical Works.	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gee Cross - -	Hyde Chapel School -	26	16	16	16	..	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..
Gildersome -	Literary Institution -	9	..	..	..	..	..	..	..	..	9	9	..	..	..	..	..	..	..	..	..	..	..	..
Glossop - -	Littlemoor Mechanics' Institution.	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gloucester - -	10, Eastgate Street - -	37	..	..	..	20	..	..	..	22	21	20	20	13	..	14	..	12	..	..	..	..	..	..
„ - -	School of Art - - -	20	12	6	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gomersal - -	Mechanics' Institution -	10	..	..	..	..	..	..	..	..	10	10	..	..	..	..	..	..	..	..	..	..	..	..
Gorton - -	Manchester, Sheffield, and Lincolnshire Railway Institution.	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Grantham - -	National School - -	29	..	..	..	9	..	2	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..
Great Harwood -	National School - -	24	..	..	..	..	..	..	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..
Great Horton -	Wesleyan School - -	24	..	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..
Greenwich - -	St. Mary's National School	20	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	Mechanics' Institution -	15	12	12	12	..	..	..	..	..	..	6	..	6	..	..	..	..	..	..	..	..	..	..
Guildford - -	County Hall - - -	45	..	..	..	12	..	19	..	10	..	14	..	..	..	..	..	..	..	..	..	..	..	..
Halifax - -	Working Men's College -	45	14	..	..	..	..	..	..	..	..	32	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	Mechanics' Institution -	15	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	School of Art - - -	10	10	5	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hammersmith -	Training College - -	38	..	..	..	38	..	..	..	38	..	..	..	..	..	38	..	..	..	..	..	..	..	..
Hampton - -	Commercial School - -	20	..	20	..	..	..	..	..	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..
Handsworth -	St. Michael's Association -	9	..	..	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	9
Harborne - -	Young Men's Christ. Assoc.	15	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	Smethwick National School	26	..	..	..	..	..	..	..	..	..	..	..	..	..	26	..	..	..	..	..	..	..	..

* Return included with Charles School, Plymouth.

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Haslingden - -	Institute - - -	26	..	..	..	..	..	..	4	..	..	10	..	..	..	25	..	..	..	..	..	..	..	..	..
Hayfield - -	Birch Vale Institution -	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Helston - -	Grammar School - -	12	..	..	..	..	..	..	..	..	..	12	11	11	..	..	..	..	..	..	..	..	..	..	..
Hereford - -	Blue School - - -	100	..	..	..	20	..	..	..	40	100	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hetton - -	Colliery School - -	25	25	25	25	..	..	10	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..
Heywood - -	Mechanics' Institution -	30	15	15	15	..	..	..	..	..	9	13	13	..	..	..	..	..	..	..	..	..	..	..	..
Highgate - -	National School - -	16	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..
Hingham - -	National School - -	24	..	..	..	..	..	14	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	12
Holbeck - -	Mechanics' Institution -	24	21	21	21	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Wesleyan School - -	45	..	..	..	..	..	..	..	..	45	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Holmfirth - -	Working Men's Club -	14	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..
Hornsey - -	British School - -	36	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	36
Horwich - -	National School - -	22	22	22	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Huddersfield -	Mechanics' Institution -	58	27	29	29	..	..	..	..	22	22	33	6	..	..	..	..	..	..	..	..	..	..	..	..
" - -	St. Paul's School - -	30	30	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Milnsbridge Mech. Inst. -	11	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hull - -	Nautical School - -	68	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	68	68	30	30
" - -	People's Institution - -	75	54	54	54	8	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	8	..
" - -	Day Street British School -	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Huntingdon -	Walden's School - -	9	..	..	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..
Hyde - -	Mechanics' Institution -	36	9	9	9	..	..	..	..	..	12	9	..	..	..	9	..	..	..	..	..	..	..	..	..
Ipswich - -	Working Men's College -	50	6	6	10	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	..	..	..	..	..
Jarrow-on-Tyne -	Mechanics' Institution -	55	47	47	47	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Keighley - -	Mechanics' Institution -	6	4	3	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kendal - -	Post Office Yard Room -	52	..	..	..	6	..	..	..	..	..	52	..	..	..	30	..	..	..	..	..	..	..	..	..
Kersley - -	British School - -	13	..	..	..	..	..	..	..	..	..	13	..	..	..	13	..	..	..	..	..	..	..	..	..

Kettering	National School	20	..	..	..	..	..	..	..	16	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	British School	30	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kilburn	St. Mary's School	24	24	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kinver	Wire Mill	14	..	..	..	..	..	..	..	..	..	14	2	..	..	14	..	..	..	..	..	..	..	..	..
Kirkstall	St. Stephen's School	4	..	..	..	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..
Lamerton	Church of England School	21	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21
Lamport	Endowed School	28	..	..	..	..	..	..	..	22	28	..	..	..	..	28	..	..	..	..	..	..	..	..	..
Lancaster	Mechanics' Institution	66	..	..	..	20	..	..	..	..	..	24	..	..	..	9	..	..	..	..	..	..	..	..	33
,,	National School	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	50
,,	School of Art	13	12	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Launceston	Grammar School	13	..	..	..	..	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	13
Leeds	Mechanics' Institution and Literary Society.	72	..	..	..	20	..	..	..	..	..	42	7	..	..	..	..	..	..	..	8	..	..	..	..
,,	St. Peter's School	60	..	..	..	..	..	..	..	..	..	48	..	..	..	..	..	..	..	..	..	..	..	..	50
,,	Young Men's Christian Association.	33	..	..	..	3	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	Working Men's Institution	21	21	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	Hunslet Mechanics' Institution.	9	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	St. Mark's National School	18	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	St. Simon's School	21	..	..	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	Art and Science Institution	44	21	21	21	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..
,, / ,,	Lancasterian School (for Schoolmasters). Art and Science Institution (for Schoolmistresses).	34	16	16	16	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
,,	School of Art	40	..	40	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lees	Parish Church School	18	16	18	18	..	..	9	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Leicester	St. Martin's School	103	..	29	..	53	..	..	..	..	41	14	14	..	..	..	..	..	..	..	..	..	..	..	..
,,	St. Margaret's School	21	..	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	Belgrave National School	26	..	..	..	..	..	..	..	6	26	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	Great Meeting School	33	..	..	..	..	..	..	..	..	28	..	..	..	..	31	..	..	..	..	..	..	..	..	..
Leigh	Christ Church School, Pennington.	8	..	..	..	..	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..
Leighton Buzzard	Working Men's Society	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Lewes	School of Art	9	..	..	9	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..
Limehouse	St. John's National School	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lincoln	School of Art	20	20	10	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	Training School	45	..	..	..	..	..	..	..	..	..	..	..	..	..	45	..	..	..	..	..	..	..	..	..
Lindley	Mechanics' Institution	20	..	..	..	..	..	..	..	..	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	National School	18	..	..	..	..	..	..	..	..	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..
Liskeard	Literary Institution	47	..	..	..	..	..	..	..	..	..	14	..	..	..	33	..	..	..	..	..	..	..	..	..
Littleborough	Church Schoolroom	7	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Liverpool	Free Library and Museum	134	..	30	..	37	..	23	..	26	33	41	..	22	..	19	..	14	..	..	..	..	..	33	..
,,	Institute	144	..	..	..	97	..	..	19	..	..	112	..	..	..	..	..	..	..	..	..	..	..	19	83

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Liverpool	Training College	68	..	..	..	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	68
Llanboidy	National School	20	..	..	..	12	..	..	..	..	20	..	..	..	..	20	..	..	..	..	..	..	..	..	..
Llanelly	Copper Works School	64	19	28	28	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	5	..	32
"	Loughor National School	9	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..
London:—																									
Battersea	St. John's College	80	..	..	..	80	..	..	..	..	..	..	..	..	..	80	..	..	..	..	..	..	..	..	80
"	Christ Church School	60	..	..	..	..	..	..	..	..	..	..	..	..	..	60	..	..	..	..	..	..	..	..	..
"	Wesleyan Chapel	18	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. John's National School	25	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bayswater	St. Matthew's Parochial School.	50	..	..	..	..	..	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..
Bermondsey	Christ Church School	17	17	17	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bethnal Green	Birkbeck School	83	..	..	..	30	..	..	..	..	55	34	..	..	..	55	..	..	..	..	..	..	..	..	55
"	National School	150	21	18	..	12	..	..	..	84	36	25	..	..	..	104	..	..	..	..	..	..	..	..	96
"	British School	66	..	66	66	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. James the Less National School.	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Blackfriars Road	South London Working Men's College.	34	22	22	..	8	..	6	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..
Boro' Road	Training College	100	..	..	..	100	..	45	..	..	..	85	..	..	..	..	..	..	..	..	..	..	..	..	100
	Boys' Model School	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	50
Bow, North	Old Ford Road School	25	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Brixton Hill	Working Men's Club	18	13	13	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Camberwell	St. Matthew's Institution	18	18	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chancery Lane	Birkbeck Literary and Scientific Institution	170	45	45	45	16	21	14	12	..	30	30	..	..	..	18	..	..	..	..	..	..	..	11	31
Charterhouse	St. Thomas' School	200	25	20	20	..	..	..	..	..	6	..	..	..	..	80	..	..	..	..	..	..	..	..	60
Chelsea	St. Mark's College	88	50	..	..	88	..	33	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	88

„	Technical School	164	107	123	125	31	..	31	23	78	78	74	..	06	..	31	..	8	..	..	..	..	..	..	65
City Road	Finsbury College	25	..	..	..	..	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..
Clapham	Christ Church School	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	St. James' School	15	15	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Clerkenwell	Technical School	15	..	12	12	..	..	..	12	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	St. Peter's School	15	15	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Eaton Square	St. Peter's Collegiate School	88	..	..	..	58	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..	..	..	..	..
Edgeware Road	Christ Chapel Boys' School	60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	60
Goswell Road	St. Barnabas' National School.	14	14	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gray's Inn Road	St. Bartholomew's School	33	..	..	..	..	..	..	..	..	..	33	..	..	..	33	..	..	..	..	..	..	..	..	..
Hackney, South	National School	29	15	..	..	..	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..
„	St. Thomas' Square School	152	25	..	..	30	..	..	..	..	..	..	..	93	..	90	..	..	..	..	..	..	..	..	70
„	Parochial School	14	14	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	St. Peter's Boys' School	25	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hampstead Road	St. James' National School	26	..	..	..	..	..	..	..	..	26	..	..	..	..	23	..	..	..	..	..	..	..	..	..
Haverstock Hill	Orphan Working School	50	..	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..	..	..	..	..
Islington, Lower	Public School	181	47	41	..	34	..	..	..	..	102	45	..	..	..	29	..	76	..	..	..	..	..	..	76
„	St. Thomas' School	55	12	..	28	..	..	..	..	..	5	28	..	..	..	25	..	..	..	..	..	..	..	..	..
„	Wesleyan School, Mintern Street.	33	33	33	33	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Youths' Institution	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kensington	School Building, Allen Street	25	..	20	24	..	..	..	24	..	..	..	..	20	..	20	..	..	..	..	..	..	..	..	..
Kentish Town	Gospel Oak School	181	90	..	..	..	..	..	..	..	..	..	..	..	..	160	..	..	..	..	..	..	..	..	..
Kingsland	North London School of Art.	10	10	1	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Knightsbridge	Albert Working Men's Club	12	11	11	..	..	..	..	..	..	..	10	..	9	..	9	..	..	..	..	..	..	..	..	19
Lambeth	Boys' School, Hercules Buildings.	187	20	79	79	..	..	..	..	..	..	..	..	78	..	..	..	..	..	..	..	..	..	..	75
„	School of Art	28	12	11	10	..	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..
„	Lambeth Baths	25	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	St. Peter's School	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Wesleyan School	16	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	16
Leadenhall Street	City of London College	84	..	26	..	20	..	..	..	..	..	29	..	..	13	..	..	..	..	..	..	..	..	..	..
Long Acre	Wilson Street	8	..	..	..	..	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..
Marylebone	Central Boys' School	70	..	..	..	..	..	..	..	..	..	..	..	50	..	40	..	50	..	..	..	..	..	..	70
„	New Quebec Club and Institution.	6	6	6	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nine Elms	Lecture Room	23	16	18	18	..	..	..	17	..	..	14	..	14	..	..	..	..	..	..	..	..	..	..	..
Notting Hill	Tabernacle School	28	..	..	..	..	..	..	..	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	..
Old Kent Road	St. Mary's School	76	..	..	..	..	..	..	..	..	..	..	..	..	..	76	..	..	..	..	..	..	..	..	..
Paddington	Greville House	14	14	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	All Saints' National School	50	..	..	..	..	..	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..
Peckham	St. Mary's College	54	54	54	..	..	..	..	..	54	54	..	..	..	..	..	..	..	..	..	..	..	..	..	54
Pimlico	St. Gabriel's and St. Saviour's School.	40	40	40	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
London—*cont.*																									
Poplar - -	All Saints' National School	39	39	39	39	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	William Street Young Men's Christian Association.	25	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..
Regent Street -	Royal Polytechnic Institution.	39	..	..	..	..	..	..	..	3	9	16	..	..	..	7	..	..	..	..	4	..	..	..	..
Somers Town -	National School - -	17	17	17	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	British School - -	88	88	88	88	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Spitalfields -	School of Art - -	12	12	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Southwark -	Swan Street Boys' National School.	23	23	23	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
St. John's Wood -	Catholic School - -	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tottenham Court Road.	St. John's School - -	22	..	12	12	..	..	..	..	..	..	11	..	11	..	..	..	..	..	..	..	..	..	..	..
Vauxhall - -	Baptist School - -	35	35	35	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	London and South-Western Railway Institution -	16	16	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Walham Green -	St. John's School - -	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Wandsworth -	Royal Patriotic Fund Boys' School.	67	..	44	..	..	..	..	..	67	67	..	..	..	..	66	..	..	..	..	..	..	..	..	65
Waterloo Road -	St. John's School - -	56	50	56	56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Westminster -	Wesleyan Training College -	144	..	..	..	76	..	..	..	..	..	70	..	..	..	..	..	..	..	..	..	..	..	..	144
" -	St. James-the-Less National School.	27	27	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Working Men's Club -	32	26	26	..	..	..	..	..	..	..	23	..	14	..	15	..	..	..	..	..	..	..	..	..
Luddenden Foot -	Day School-room - -	50	..	..	..	38	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Lutterworth -	Cottage School, Coventry Road.	18	..	..	..	..	..	..	..	18	18	..	..	..	..	18	..	..	..	..	..	..	..	..	..

Macclesfield -	Modern Free School -	38	..	..	..	..	..	..	..	..	..	38	..	..	..	..	..	..	..	..	..	..	..	..	..
Manchester -	Rusholme Public Hall and Library.	12	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Mechanics' Institution	217	114	114	114	20	..	21	18	21	26	26	6	2	..	67	..	..	..	..	..	..	..	..	60
" -	St. Luke's, Cheetham	12	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
" -	Free Grammar School	151	90	90	90	..	..	60	..	130	80	90	30	..	..	..	..	60	..	..	..	..	..	..	60
" -	Roby Society School	12	10	6	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Building Trades Institution	72	42	..	30	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	St. George's National School	6	6	6	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Hulme, Working Men's Institute.	34	16	16	..	..	..	..	..	..	..	6	6	..	..	4	..	5	..	..	..	..	..	..	..
" -	Mechanics' Institution and Owen's College.	120	56	56	56	24	..	..	..	..	..	60	..	..	..	32	..	..	..	..	..	..	..	..	..
" -	Presbyterian School, Ancoats	11	11	11	11	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..
Market Harborough	British School -	6	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" "	National School -	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Marple -	Albert School -	16	16	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Melksham -	British School -	20	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..
Meltham -	Church School -	19	19	..	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Melton Mowbray -	Church School-room	8	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..
Merthyr Tydvil -	Tydvil School -	42	35	..	..	33	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Middlesborough -	St. John's School -	8	..	..	..	..	..	..	..	8	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..
Middleton -	National School -	14	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..	10	..	..	..	..	..	..	..
" -	Holy Trinity, Parkfield	20	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	10
Millwall -	Presbyterian School -	16	16	..	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..
Mirfield -	Literary and Scientific Society.	13	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..
Morley -	British School -	17	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..
Mossley -	Mechanics' Institution	12	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Moulton -	National School -	12	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Mowcop -	National School -	8	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Murton -	Colliery School -	35	35	35	35	..	..	..	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nailsworth -	National School-room	4	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..	4	..	..	..	..	..	..	..
Nelson-in-Marsden -	Lomeshaye Mills Schools	27	25	25	25	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..
Newark-on-Trent -	Mechanics' Institution	19	..	..	..	..	..	..	..	6	..	11	..	..	..	6	..	..	..	..	..	..	..	..	..
Newcastle-on-Tyne	Elswick Works Mechanics' Institution.	126	85	85	85	..	15	27	27	30	30	30	..	..	..	..	..	..	..	..	..	..	..	27	..
" "	Mechanics' Institution, New Bridge Street.	53	50	50	50	..	..	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..
" "	Stephenson Institution	40	40	40	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" "	School of Art -	35	15	10	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Newcastle - under - Lyne.	School of Art -	14	10	3	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Newton Heath -	All Saints School	12	..	..	..	4	..	..	..	..	..	12	..	..	..	6	..	..	..	..	..	..	..	..	..
Northallerton -	Institution -	8	..	..	..	..	..	..	..	6	..	4	..	..	..	2	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Northampton	Museum	120	..	..	..	..	..	..	..	33	25	30	..	..	..	12	..	..	..	..	..	..	..	..	96
"	St. Sepulchre's National School.	16	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..
North Ormesby	Church Institute	12	..	16	..	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..
North Shields	Free Library	71	53	53	53	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Peter's School	61	61	61	61	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nottingham	Mechanics' Institution	227	..	..	..	..	..	..	..	..	25	30	..	13	..	20	..	..	..	..	..	..	..	..	150
Norwich	Presbyterian School	65	..	..	12	21	..	..	..	..	..	..	..	40	..	..	..	..	..	..	..	..	..	..	..
"	Thorpe Hamlet Boys' School	16	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11
Oadby	National School	7	..	..	..	..	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..
Oldbury	National School	84	..	60	..	..	..	..	..	..	59	31	..	54	..	54	..	..	..	..	..	..	..	..	..
"	Messrs. Chance's Institution	62	..	..	..	..	..	..	..	..	..	..	..	..	..	62	..	..	..	..	..	..	..	..	62
Oldham	Science and Art School	75	55	56	30	19	..	12	15	..	..	..	..	..	..	..	..	10	4	..	..	..	..	13	..
"	Glodwick Mutual Improvement Society.	20	18	19	20	..	..	9	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Analytic Literary Institution.	41	33	33	33	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Werneth Mechanics' Institution.	24	24	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Openshaw	Ashbury Works	28	27	28	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Wesleyan Day School	18	18	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Oswaldtwistle	Wesleyan School	75	..	..	..	..	..	..	..	..	..	..	..	..	..	51	..	..	..	..	..	..	..	..	75
"	Busk School	50	..	..	..	..	..	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..
Oundle	British School	55	..	..	..	..	..	..	..	..	..	..	..	..	..	55	..	..	..	..	..	..	..	..	..
Oxford	Town Hall, St. Aldates St.	40	..	..	10	14	..	..	..	..	..	20	..	..	..	15	..	..	..	..	..	..	..	..	..
"	Wesleyan School	25	..	..	..	..	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..
Padiham	National School	32	20	32	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

"	Wesleyan School	47	..	..	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	42
Patricroft	Mechanics' Institution	58	18	18	18	..	..	..	5	44	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pavenham	Church of England School Room.	25	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	25
Pembroke Dock	Mechanics' Institution	16	..	..	..	16	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pendeen	National School	16	..	..	..	..	..	..	..	..	..	16	..	..	16	..	..	..	..	7	..	..	..	..
Pendleton	Mechanics' Institution	21	4	17	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Penzance	School of Science and Art	33	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8
"	Sancreed Nat. Sch	5	..	..	..	..	..	..	..	..	..	..	..	..	..	5	..	..	..	..	..	..	..	..
Peterborough	St. Peter's College	43	..	..	..	9	..	..	..	..	..	..	..	..	..	34	..	..	..	..	..	..	..	43
Pitsford	National School	15	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..
Plumstead	Burrage Road School	104	50	50	50	..	..	..	..	..	..	..	..	..	42	..	..	..	..	..	..	..	..	..
"	St. James's School	103	83	83	83	20	..	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20	..
Plymouth	Courtenay Street Science School.	208	40	23	8 *9	43	6	6	4	3	23	39	8	..	..	3	3	12	12	..	..	..	..	10
"	Charles National School	138	14	61	43 14*	32	..	7	10	40	..	..	..	..	..	..	..	..	..	..	..	10	3	25	64
"	Navigation School	6	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	2	..	..
Portland	The Grove School	14	..	..	..	10	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Portsmouth and Gosport.	National School	26	..	..	15*	..	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..
Preston	Institution, Avenham	25	13	9	5	..	..	..	..	..	..	11	..	..	..	6	6	..	..	..	..	..	..	..
Queensbury	National School	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..
Rawtenstall	Mechanics' Institution	31	31	31	31	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Irwell Institution	35	..	..	..	..	..	..	..	13	..	..	..	..	..	12	..	..	..	..	..	..	..	35
Reading	School of Art	25	15	10	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Redditch	Literary and Scientific Institution.	17	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..
Redruth	The Institution	10	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Retford, East	Wesleyan Day School	20	..	..	..	..	..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	20
Richmond	Petersham School	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Riddings	Mutual Improvement Association.	10	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..
Ripon	Training College	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	32
Rochdale	British School	172	115	110	110	..	..	..	25	..	37	37	..	..	..	35	..	35	..	..	..	..	..	..
Rothwell	" "	33	..	..	..	..	..	..	..	33	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rowley Regis	National School	23	..	..	..	..	..	..	..	..	..	..	..	..	..	23	..	..	..	..	..	..	..	..
Royton	St. Paul's National School	34	34	34	34	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Salford	Broughton Road Wesleyan School.	28	..	..	..	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	..	..	..	..
"	Working Men's College	68	36	30	30	..	..	..	..	..	..	6	6	..	..	5	..	..	..	..	..	..	..	24
St. Austell	National School	29	..	..	18	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..
St. Burian	National School	12	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..

* Naval Architecture.

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
St. Helen's - -	Commercial School - -	25	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..
St. Ives - -	National School - -	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
St. Just - -	The Institution - -	14	..	..	..	..	..	..	..	..	..	..	..	9	9	..	..	..	..	5	..	..	..	..	7
Salisbury - -	School of Science and Art -	25	20	2	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Saltaire - -	Literary Institution - -	18	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..
Saltley - -	Training College - -	43	..	..	..	43	..	..	..	..	..	..	..	..	..	43	..	..	..	..	..	..	..	..	43
Scarborough -	Mechanics' Institution -	23	..	..	..	6	..	..	..	..	..	..	..	3	..	2	..	..	7	..	..	2	..	..	3
Seaham - -	Colliery School - -	20	20	20	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Seaton Delaval -	Colliery School - -	45	45	45	45	..	..	..	45	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Shaw - - -	National School - -	19	19	19	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sheerness - -	British School - -	26	26	26	6*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sheffield - -	Church and Educational Institute.	11	..	..	..	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	St. Paul's School - -	121	..	..	..	9	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Mechanics' Institution -	38	..	..	..	..	..	..	..	..	..	138	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Wesleyan Educational Institute.	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Church Institute - -	58	..	..	..	26	..	3	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	16
" - -	School of Art - -	22	8	22	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Shelton - -	National School - -	13	..	..	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..
Shrewsbury - -	School of Art - -	31	31	31	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Skelmanthorpe -	National School - -	12	..	..	..	6	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	7
Slough - -	Mechanics' Institution -	45	40	40	40	..	..	..	..	..	..	18	18	..	..	..	..	..	..	..	..	..	..	..	..
Southampton -	Hartley Institute - -	211	..	..	..	11	..	..	..	..	..	..	..	..	..	200	..	..	..	..	..	..	..	..	..
Southminster -	National School - -	16	..	..	..	..	..	..	..	11	8	..	..	..	..	16	..	..	..	..	..	..	..	..	..
Southport - -	Athenæum - -	14	..	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
South Shields -	Mechanics' Institution -	19	..	..	..	..	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..	..
" - -	Tyne Docks Mechanics' Institution.	20	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..

" - -	St. Hilda's C. Y. M. A. -	52	52	52	52	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..
" - -	Jarrow Chemical Works -	30	29	29	29	..	..	..	29	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..
Stainland - -	Independent School - -	15	..	..	..	..	..	..	..	..	..	15	7	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Holywell Green Mechanics' Institution.	36	..	23	..	..	..	..	..	..	..	18	9	..	..	..	..	..	..	..	..	..	..	..	..
Stalybridge - -	Mechanics' Institution -	23	23	23	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Staveley - -	Works' School - -	15	12	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Village School - -	17	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stepney - -	Red Coat School - -	10	10	10	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	St. Paul's School - -	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	50
" - -	Colet Boys' School - -	50	..	..	..	22	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..	..	50
Stockport - -	Mechanics' Institution -	52	24	24	24	..	..	..	..	16	5	10	..	5	..	10	..	..	..	..	..	..	..	..	16
" - -	Sunday School Improvement Society.	54	18	26	18	..	..	..	..	4	..	24	..	8	..	24	..	..	..	..	..	..	..	..	8
Stoke-on-Trent -	School of Art - - -	17	14	3	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stourbridge - -	Grammar School - -	26	9	..	..	..	..	..	..	..	..	26	..	..	..	9	..	..	..	..	..	..	..	..	..
Stratford (Essex) -	Working Men's Hall -	25	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Boys' British School -	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stratford-on-Avon -	National School - -	12	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Stroud - -	The Institute - - -	90	..	..	10	..	..	..	..	..	..	..	..	67	..	20	..	56	15	..	..	..	..	..	..
" - -	School of Art - - -	12	6	6	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sunderland - -	School of Art - - -	44	26	12	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Monk Wearmouth Colliery School.	39	39	39	39	..	..	..	39	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Working Men's College -	25	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sunninghill - -	Wesleyan School - -	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Sutton - -	National School - -	21	..	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..	21
Sutton Coldfield -	Town Hall - - -	17	..	..	..	..	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	17
Swansea - - ; " - -	Royal Institute of South Wales. ; Oxford Street Nat. Sch. -	91	15	5	4	48	..	7	6	9	11	25	..	..	..	..	..	..	..	..	3	16	..	..	..
Swinton - -	Mechanics' Institution -	16	16	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tavistock - -	British School - -	60	..	..	..	3	..	..	..	..	..	15	..	..	..	16	..	..	..	..	..	..	..	..	40
" - -	Duke of Bedford's School, Gulworthy.	60	..	..	..	..	..	..	..	37	..	..	..	..	..	14	..	..	..	..	..	..	..	8	35
" - -	National School - -	80	..	..	..	16	..	..	..	..	..	17	..	..	..	..	..	24	..	..	..	..	..	..	63
" - -	St. Mary Tavy National School.	18	..	..	..	..	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	18
Tavistock - -	School of Art - - -	15	7	4	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tebworth - -	Wesleyan School - -	8	..	..	..	..	..	..	..	2	..	6	..	..	..	1	..	..	..	..	..	..	..	..	..
Thorne - -	Brooke's Grammar School	16	13	9	6	7	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Thornton - -	Mechanics' Institution -	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Thrapston - -	National School - -	15	..	..	..	..	..	..	..	..	15	..	..	..	..	6	..	..	..	..	..	..	..	..	..
" - -	British School - -	28	..	..	..	..	..	..	..	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	..
Toddington - -	National School - -	6	..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Toddington - -	Wesleyan School - -	14	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..
Todmorden - -	Mechanics' Institution -	27	27	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Topsham and Woodbury.	Mutual Improvement Society.	25	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Torquay - -	School of Science and Art -	98	..	..	..	..	..	..	..	29	91	..	..	..	..	24	..	..	..	..	..	..	..	..	..
Towcester - -	National School - -	14	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Truro - -	British School - -	24	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	24
" - -	Royal Institution - -	13	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..
Turton - -	Chapel-town Institute -	17	17	17	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tyldesley - -	Mechanics' Institution -	48	30	30	30	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ulverston - -	Proprietary School - -	18	..	..	..	12	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..
Wakefield - -	Holy Trinity Young Men's Society.	14	..	..	..	..	..	..	..	..	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Smyth Street Academy -	30	..	..	..	..	..	..	..	..	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Mechanics' Institution -	29	..	..	..	..	..	..	..	..	..	29	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Holy Trinity Boys' School -	135	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	35
Walker - -	Alkali Works British School	31	31	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wallingford - -	School of Art - - -	25	..	..	..	..	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..
Walsall - -	Wesleyan School - -	50	..	25	30	..	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	30
Watford - -	Literary Institution - -	36	..	..	..	..	..	..	..	..	..	..	..	..	..	36	..	..	..	..	..	..	..	..	..
Wednesbury -	Moxley National School -	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..
" - -	St. John's School - -	40	..	..	..	..	..	..	..	..	..	..	..	..	..	40	..	..	..	..	..	..	..	..	..
Weedon - -	Girls' School - - -	12	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wellingborough -	Lower Grammar School -	64	..	..	..	..	..	..	..	23	51	..	..	..	..	28	..	..	..	..	..	..	..	..	..
West Bromwich -	St. Peter's School - -	20	..	..	..	..	..	..	..	..	..	6	..	..	..	20	..	..	..	..	..	..	..	..	10
Westbury on Trym	Girls' National School -	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
West Gorton -	St. Mark's National School -	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9

Whaleybridge -	Spring Bank Chapel -	8	8	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Whitehaven -	Science Association -	30	..	..	..	..	..	..	..	..	..	28	..	6	..	..	..	..	..	..	..	..	..	..	..
Whitworth -	Literary Institution -	20	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wickham Market -	National School -	12	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Wigan -	Mech. Inst. -	95	36	42	42	..	..	..	..	..	..	32	..	..	..	2	..	..	..	22	..	..	..	22	4
Wilmslow -	Fulshaw Day School -	9	9	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wilsden -	Mechanics' Institution -	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Winchester -	British School -	15	..	..	..	8	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..
Windsor -	Mechanics' Institution -	19	19	..	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wisbech -	Working Men's Institute	35	..	..	..	..	..	..	..	..	10	..	..	..	..	33	..	..	..	..	..	..	..	..	..
Woburn -	Boys' School -	6	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Woking -	St. John's School -	41	..	..	..	7	..	5	..	36	..	21	..	..	..	37	..	..	..	..	..	..	..	..	34
Woking Station -	Commercial School, Knaphill.	26	..	..	..	..	..	..	..	10	10	26	..	..	..	..	..	..	30	..	..	..	..	..	..
Wolverhampton -	Great Western Railway Institution.	33	26	..	..	28	..	..	..	..	..	33	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	St. Peter's School -	40	..	..	..	..	..	..	..	20	..	..	..	30	..	30	..	..	..	..	..	..	..	..	30
" -	St. John's School -	14	..	..	..	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	14
Wolverton -	Science and Art Institution	56	10	10	..	22	..	18	..	46	46	18	..	..	..	27	..	..	..	..	18	..	..	..	..
Woodville -	National School -	6	..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..
Woolwich -	Royal Arsenal Science Classes.	139	47	47	47	21	..	33	33	..	9	56	10	13	6	31	..	..	..	..	17	..	..	33	6
" -	National School -	24	16	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Pres. District School -	81	23	41	41	..	..	..	..	..	..	42	..	75	..	..	..	..	..	..	..	..	..	..	..
" -	St. Michael's School -	14	14	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Worcester -	Young Men's Christian Association. St. Martin's School - Grove House -	286	73	45	..	..	..	..	..	..	44	38	..	74	..	211	..	..	..	..	..	..	..	..	..
" -	St. John's School -	53	..	..	..	..	..	..	..	..	..	..	..	..	..	52	..	..	..	..	..	..	..	..	..
" -	Trade School -	43	42	43	42	..	..	42	42	42	42	..	..	..	..	42	..	..	..	..	..	..	..	42	42
" -	Trade School Evening Class	53	30	30	30	..	..	23	23	20	20	..	..	..	..	25	..	..	..	..	..	..	..	23	20
Yarmouth (Great) -	Naval School and Grammar School.	100	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	80	80	..	..
" -	School of Art -	9	8	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
York -	The Institute -	22	..	..	..	5	..	..	..	..	..	10	..	5	..	..	..	..	..	..	..	..	..	..	2
" -	Blue Coat School -	17	..	..	..	15	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	15
" -	Training School -	14	..	..	..	13	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	11
" -	Hope Street British School	72	..	..	..	..	..	..	..	..	..	72	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	School of Art -	13	13	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
								SCOTLAND.																	
Aberdeen	Mechanics' Institution	47	..	..	..	22	..	11	..	..	..	16	..	..	..	..	..	9	6	..	..	..	..	..	..
Alexandria	Mechanics' Institution	44	..	16	..	13	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..
Baillieston	Crosshill School	12	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Banton	Banton School	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Beith	New Street School	45	..	..	..	14	..	..	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	45
Brechin	School-room	28	10	..	..	1	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..
Corsock	Girls' School	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	5	..	..	..	..	..	..
Cults	School-room	12	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dingwall	Academy	13	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dumbarton	Burgh Academy	140	..	30	..	50	..	30	..	80	..	..	..	..	..	..	..	..	..	..	..	..	..	..	80
Dundee	High School	89	47	65	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Edinburgh	Free Church Training College.	56	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	40
"	Watt Institute	490	..	..	..	163	..	..	..	..	..	..	136	..	..	..	..	..	..	..	..	..	..	..	106
"	15, Buccleuch Place	24	..	..	..	..	..	..	..	..	..	..	..	..	..	24	24	24	..	..	..	..	..	..	..
"	Established Church Training College.	62	..	..	..	62	..	..	..	..	62	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Elgin	Academy	20	7	13	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Fortrose	Mechanics' Institution	13	13	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13
Glasgow	Secular School	131	22	22	..	..	..	..	..	..	..	17	..	..	..	86	50	..	..	..	17	..	..	..	64
"	Andersonian University	992	..	..	..	22	12	..	878	..	..	406	406	..	..	191	..	135	135	..	..	..	..	870	..

"	Mechanics' Institution	218				118						100												
"	Established Church Normal School.	54														54								
"	St. Stephen's School	36				36																		
"	Port Dundas School	33														33								
"	St. George's School	50														50								
Inverness	School of Science and Art	18	16	6	14																			
"	Royal Academy	41	20	1	2	37																		
Johnstone	Quarrelton Parish School	46														46								
Kilmarnock	East George St. Academy	82	42	42		25			12	12														
"	New Academy	52		12																				40
"	School of Art	7		6	1																			
Kirkcaldy	Burgh School	34		34																				
Kirkwall	Grammar School	35				18																		21
Leith	Navigation School	278				188															172	165	68	
"	St. James' School	39						35																35
"	School of Art	34	34	17	16																			
Lumphanan	Parish School	18																						18
Nairn	Gen. Assembly's School	12	12																					
Newhills	Stoneywood School-room	11				11		11																
Paisley	School of Art	25	25																					
"	Sessional School	44														44								
Perth	Sessional School	9	4	2	3																			
Rothesay	Thomson Institution	6				6																		
St. Andrews	Madras College	63		44		19																		
Stirling	Science and Art School	18	18	18	18																			
Tarbat	Parochial School	34				28								34		20	20					18			34
	IRELAND.																							
Aghnagar	National School	25							25	25														25
Ahoghill	National School	20							20	20														
Anahilt	Endowed Free School	15				6															2			15
Antrim	Male National School; Main St. National School; Ladyhill National School	70				10				28		—	12		14		—							30

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Ardara - -	Female National School -	15	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15
Armagh - -	Gosford Place National School.	63	..	..	..	20	..	..	..	63	63	..	..	40	..	19	..	..	..	..	..	..	..	..	23
„ - -	College Street School -	30	..	..	..	..	..	..	..	30	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..
Athlacca - -	National School - -	18	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Athlone - -	St. Mary's School - -	34	..	..	..	..	..	..	..	16	12	..	..	25	..	22	..	..	..	..	..	..	..	25	..
„ - -	Ranelagh School - -	26	17	..	..	25	..	19	..	21	21	..	..	25	..	25	25	..	..	..	..	..	..	..	..
„ - -	Anchorsbower National School.	53	..	..	..	22	..	..	..	40	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Athy - - -	Town Hall - - -	32	..	..	..	..	..	..	..	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Aughnacloy - -	Court House - - -	49	..	..	..	..	..	..	..	49	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bagenalstown -	National School - -	30	..	..	..	23	9	23	..	30	30	..	..	..	..	9	..	..	..	..	..	..	..	..	..
Bailieboro' - -	Model School - - -	122	..	..	..	30	..	..	..	..	122	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballee - -	National School - -	19	..	..	..	..	..	..	..	17	11	..	..	..	..	..	..	..	..	..	..	..	..	..	11
Ballincollig - -	National School - -	15	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballybay - -	National School - -	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15
Ballybofey - -	Town Hall - - -	36	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	36
Ballymena - -	Model School - - -	15	..	..	..	15	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	Guy's National School -	14	..	..	..	..	..	..	..	14	14	..	..	..	..	10	..	..	..	..	..	..	..	..	..
„ - -	National School - -	10	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	Harryville National School	12	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	Crebilly National School -	6	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballymoney - -	Town Hall - - -	23	..	..	..	10	..	..	..	..	..	..	..	..	..	23	..	..	..	..	..	..	..	..	23
Ballynahinch -	National School - -	13	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13
„ -	Town Hall - - -	10	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10
Ballyvicknakelly -	National School - -	10	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	10
Ballywalter - -	Park School - - -	36	..	..	..	..	..	..	..	..	16	..	..	18	..	20	..	..	..	..	..	..	..	..	..
Ballywilly - -	National School - -	14	..	..	..	12	..	..	..	14	14	..	..	..	..	10	..	..	..	..	..	..	..	..	14

Balyna	National School	27	..	..	..	..	..	..	..	..	27	..	..	27	..	5	..	..	..	..	..	..	..	..	..
Bandon	Allin Institution	50	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	45
Bangor	Endowed School	16	..	..	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..
Barnesmore	National School	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	18
Belfast	Fisherwick Place School	71	..	..	..	23	..	10	..	9	9	..	..	..	..	24	..	..	..	..	..	..	..	..	31
"	Frederick Street National School.	36	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	36
"	Wellington Academy	32	..	..	..	31	..	20	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Victoria Place School	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	50
"	Northumberland Street National School.	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
"	Union Place National School	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..
"	Conway Street National School.	23	..	..	..	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Model School	60	29	29	29	59	..	40	..	40	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Academy Street, No. 1, National School.	54	..	..	..	..	..	..	..	32	42	..	..	23	..	9	..	..	..	..	..	..	..	..	..
		20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
"	Linfield Road National School.	35	..	..	..	..	..	..	..	..	..	..	..	35	..	..	..	..	..	..	..	..	..	..	..
"	Brown Street National School.	56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	56
"	Nelson Street National School.	34	..	..	..	26	..	..	..	28	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	People's Literary Institution.	27	..	11	11	9	..	5	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11	10
"	May Street National School	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15
"	Mercantile Academy	35	..	..	..	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Bridge End National School	10	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	New Road Street National School.	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	23
"	Townsend Street National School.	60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	60
"	Albion Street National School.	16	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16
"	Canning Street Academy	44	..	..	..	..	..	..	..	..	36	..	..	..	..	..	..	..	..	..	..	..	..	..	18
"	Tennent Street National School.	12	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Belfast	Clarence Place Hall	12	..	..	..	9	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Beragh	Loan Fund Office	16	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bessbrook	School House	10	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bonecastle	National School	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10
Bornafea	National School	9	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bruckless	National School	30	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30
Bushmills	National School	22	..	..	..	..	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Caledon	School House	10	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Callan	Academy	26	..	..	..	..	..	26	..	..	26	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Carlow	Christian School	28	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Carrickfergus	Model School	42	..	..	..	13	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	7	6	..	35
Castleblaney	Annayallo National School	12	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Castlederg	Edward's School	26	..	..	..	21	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	25
Castlewellan	Annsboro' National School	15	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cloncore	National School	10	..	..	..	2	..	..	..	10	2	..	..	..	..	2	..	..	..	..	..	..	..	..	2
"	Eglish National School	12	..	..	..	6	..	..	..	12	3	..	..	..	..	4	..	..	..	..	..	..	..	..	12
Clonmel	Model School	32	..	..	..	32	..	..	..	..	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Mechanics' Institution	12	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Coal Island	Infant School	31	..	..	..	..	..	..	..	..	31	..	..	..	..	..	..	..	..	..	..	..	..	..	31
Coleraine	Model School	48	..	..	..	..	..	..	..	..	39	..	..	..	..	..	..	..	..	..	..	..	..	..	16
Comber	Smyth's National School	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Lisbarnet National School	20	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..
Connor	National School	13	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cooraclare	National School	40	..	..	..	37	..	..	..	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	40
Cork	Central Model School	37	..	..	..	32	..	..	..	34	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..
"	Carmichael National School	65	..	..	..	28	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	58
"	St. Nicholas National School	59	..	..	..	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	59
"	School of Art	12	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cormeen	National School	22	..	..	..	..	..	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	22
Cottown	National School	35	..	..	..	..	..	..	..	33	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Crossgar	National School	13	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cullybackey	National School	73	..	..	..	..	..	..	..	73	73	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Teesham National School	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	35
Derrygonnelly	Lisded National School	31	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30
Derrylin	Kinawley National School	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Donaghadee	National School	43	..	..	..	..	..	..	..	43	..	..	..	..	..	43	..	..	..	..	..	..	..	..	..

"	Shore Street National Sch.	20	..	..	..	..	..	..	..	18	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Donoughmore	Lecture Room	7	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Downpatrick	John Street National School	40	..	..	..	12	..	..	..	31	31	..	..	..	..	..	..	..	..	..	..	..	..	..	6
Drogheda	St. Mary's National School	16	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dromara	Court House	14	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	14
Dromore	Corbally National School	14	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Drumaviah	National School	43	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	43
Drumlough	National School	12	..	..	..	..	..	..	..	12	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Dublin	Central Model School	199	..	15	17	..	..	..	..	169	..	..	..	..	..	..	..	..	..	..	..	..	..	..	28
"	55, Aungier Street	20	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8	..	..	12
"	Methodist School	30	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Young Men's Christian Association.	12	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Dundalk	Free Library																								
"	Educational Institution	95	20	33	33	47	..	4	..	27	37	40	..	..	..	..	..	..	..	..	..	31	..	..	40
"	Quay Street School																								
"	Jocelyn Street																								
Dundrod	National School	28	..	..	..	8	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dundrum	Endowed School	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	24	..	..	..
Dungannon	Parochial School	30	..	..	..	..	..	..	..	3	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Dungiven	National School	12	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dunmanway	Chapel School-house	64	..	..	..	64	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Reenoscrena National School	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ederney	Moneyvriece and Aghaghaffart National School.	14	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Enniskillen	Model National School	50	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Rossdoney National School	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21
Galway	Model School	18	..	..	..	18	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gilford	National School	38	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	37
Grange O'Neilland	Parochial School	16	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16
Grey Abbey	National School	20	..	..	..	12	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Hillsborough	Boys' School	30	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30
Holywood	Sullivan's Sch. and Acad.	78	..	..	..	26	..	..	..	..	50	50	..	..	..	45	..	..	..	..	..	..	..	..	60
Kilkee	National School	43	..	..	..	43	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kilkenny	Model School	56	..	..	..	15	..	..	..	..	37	..	..	..	..	..	..	..	..	..	..	..	..	..	56
"	Model Farm																								
"	Pocock Institution	31	..	..	..	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	31
Killinchy	Schoolroom	30	..	..	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..
Killybegs	National School	28	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	28
Killylea	School House	24	..	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kilmihil	Leitrim National School	13	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10
Kilmore	School	20	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Kircubbin	National School	13	..	..	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	13

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Toddington - -	Wesleyan School - -	14	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..
Todmorden - -	Mechanics' Institution -	27	27	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Topsham and Woodbury.	Mutual Improvement Society.	25	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Torquay - -	School of Science and Art -	98	..	..	..	..	..	..	..	29	91	..	..	..	..	24	..	..	..	..	..	..	..	..	..
Towcester - -	National School - -	14	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Truro - -	British School - -	24	..	..	..	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	24
" - -	Royal Institution - -	13	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..
Turton - -	Chapel-town Institute -	17	17	17	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tyldesley - -	Mechanics' Institution -	48	30	30	30	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ulverston - -	Proprietary School - -	18	..	..	..	12	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..
Wakefield - -	Holy Trinity Young Men's Society.	14	..	..	..	..	..	..	..	..	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Smyth Street Academy -	30	..	..	..	..	..	..	..	..	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Mechanics' Institution -	29	..	..	..	..	..	..	..	..	..	29	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Holy Trinity Boys' School -	135	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	35
Walker - -	Alkali Works British School	21	21	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wallingford - -	School of Art - - -	25	..	..	..	..	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..
Walsall - -	Wesleyan School - -	50	..	25	30	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	30
Watford - -	Literary Institution - -	36	..	..	..	..	..	..	..	..	..	..	..	..	..	36	..	..	..	..	..	..	..	..	..
Wednesbury -	Moxley National School -	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..
" - -	St. John's School - -	40	..	..	..	..	..	..	..	..	..	..	..	..	..	40	..	..	..	..	..	..	..	..	..
Weedon - -	Girls' School - - -	12	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wellingborough -	Lower Grammar School -	64	..	..	..	..	..	..	..	23	51	..	..	..	..	28	..	..	..	..	..	..	..	..	..
West Bromwich -	St. Peter's School - -	20	..	..	..	..	..	..	..	..	..	6	..	..	..	20	..	..	..	..	..	..	..	..	10
Westbury on Trym	Girls' National School -	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
[illegible]	St. Mark's National School -	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9

Whaleybridge -	Spring Bank Chapel -	8	8	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Whitehaven -	Science Association - -	30	..	..	..	..	..	..	..	..	..	28	..	6	..	..	..	..	..	..	..	..	..	..	..
Whitworth - -	Literary Institution - -	20	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wickham Market -	National School - -	12	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Wigan - -	Mech. Inst. - - -	95	38	42	42	..	..	..	..	..	..	32	..	..	..	2	..	..	..	22	..	..	..	22	4
Wilmslow - -	Fulshaw Day School -	9	9	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wilsden - -	Mechanics' Institution -	18	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Winchester - -	British School - -	15	..	..	..	8	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..
Windsor - -	Mechanics' Institution -	19	19	..	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wisbech - -	Working Men's Institute	35	..	..	..	..	..	..	..	..	10	..	..	..	..	33	..	..	..	..	..	..	..	..	..
Woburn - -	Boys' School - - -	6	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Woking - -	St. John's School - -	41	..	..	..	7	..	5	..	36	..	21	..	..	..	37	..	..	..	..	..	..	..	..	34
Woking Station -	Commercial School, Knaphill.	26	..	..	..	..	..	..	..	10	10	26	..	..	..	..	..	..	30	..	..	..	..	..	..
Wolverhampton -	Great Western Railway Institution.	33	26	..	..	28	..	..	..	..	..	33	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	St. Peter's School - -	40	..	..	..	..	..	..	..	20	..	..	..	30	..	30	..	..	..	..	..	..	..	..	30
" -	St. John's School - -	14	..	..	..	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	14
Wolverton - -	Science and Art Institution	56	10	10	..	22	..	18	..	46	46	18	..	..	..	27	..	..	..	..	18	..	..	..	..
Woodville - -	National School - -	6	..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..
Woolwich - -	Royal Arsenal Science Classes.	139	47	47	47	21	..	33	33	..	9	56	10	13	6	31	..	..	..	..	17	..	..	33	6
" - -	National School - -	24	16	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Pres. District School -	81	23	41	41	..	..	..	..	..	..	42	..	75	..	..	..	..	..	..	..	..	..	..	..
" - -	St. Michael's School -	14	14	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Worcester - -	Young Men's Christian Association. St. Martin's School - Grove House - -	286	73	45	..	..	..	..	..	..	44	38	..	74	..	211	..	..	..	..	..	..	..	..	..
" - -	St. John's School - -	52	..	..	..	..	..	..	..	..	..	..	..	..	..	52	..	..	..	..	..	..	..	..	..
" - -	Trade School - - -	42	42	42	42	..	..	42	42	42	42	..	..	..	..	42	..	..	..	..	..	..	..	42	42
" - -	Trade School Evening Class	52	30	30	30	..	..	23	23	20	20	..	..	..	..	25	..	..	..	..	..	..	..	23	20
Yarmouth (Great) -	Naval School and Grammar School.	100	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	80	80	..	..
" - -	School of Art - - -	9	8	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
York - - -	The Institute - - -	22	..	..	..	5	..	..	..	..	..	10	..	5	..	..	..	..	..	..	..	..	..	..	2
" - - -	Blue Coat School - -	17	..	..	..	15	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	15
" - - -	Training School - -	14	..	..	..	13	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	11
" - - -	Hope Street British School	72	..	..	..	..	..	..	..	..	..	72	..	..	..	..	..	..	..	..	..	..	..	..	..
" - - -	School of Art - - -	13	13	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

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						SCOTLAND.																			
Aberdeen	Mechanics' Institution	47	..	..	..	22	..	11	..	..	..	16	..	..	..	..	..	9	6	..	..	..	..	..	..
Alexandria	Mechanics' Institution	44	..	16	..	13	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..
Baillieston	Crosshill School	12	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Banton	Banton School	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Beith	New Street School	45	..	..	..	14	..	..	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	45
Brechin	School-room	28	10	..	..	1	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..
Corsock	Girls' School	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	5	..	..	..	..	..	..
Cults	School-room	12	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dingwall	Academy	13	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dumbarton	Burgh Academy	140	..	30	..	50	..	30	..	80	..	..	..	..	..	..	..	..	..	..	..	..	..	..	80
Dundee	High School	89	47	65	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Edinburgh	Free Church Training College.	56	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	40
"	Watt Institute	490	..	..	..	163	..	..	..	..	..	..	136	..	..	..	..	..	..	..	..	..	..	..	106
"	15, Buccleuch Place	24	..	..	..	..	..	..	..	..	..	..	..	..	..	24	24	24	..	..	..	..	..	..	..
"	Established Church Training College.	62	..	..	..	62	..	..	..	..	62	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Elgin	Academy	20	7	13	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Fortrose	Mechanics' Institution	13	13	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13
Glasgow	Secular School	181	23	23	..	..	..	..	..	..	..	17	..	..	..	86	50	185	185	..	17	..	..	370	64
"	Andersonian University	992	..	..	..	23	12	..	378	..	..	406	406	..	..	191	..	..	..	..	..	..	..	..	..

„	Mechanics' Institution	218	..	..	..	118	..	..	..	..	..	100	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Established Church Normal School.	54	..	..	..	..	..	..	..	..	..	..	..	..	..	54	..	..	..	..	..	..	..	..	..
„	St. Stephen's School	26	..	..	..	26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Port Dundas School	33	..	..	..	..	..	..	..	..	..	..	..	..	..	33	..	..	..	..	..	..	..	..	..
„	St. George's School	50	..	..	..	..	..	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..
Inverness	School of Science and Art	18	16	6	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Royal Academy	41	20	1	2	37	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Johnstone	Quarrelton Parish School	46	..	..	..	..	..	..	..	..	..	..	..	..	..	46	..	..	..	..	..	..	..	..	..
Kilmarnock	East George St. Academy	83	43	43	..	25	..	..	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	New Academy	53	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	40
„	School of Art	7	..	6	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kirkcaldy	Burgh School	34	..	34	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kirkwall	Grammar School	35	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21
Leith	Navigation School	278	..	..	..	138	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	172	165	68	..
„	St. James' School	39	..	..	..	..	..	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	35
„	School of Art	34	34	17	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lumphanan	Parish School	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13
Nairn	Gen. Assembly's School	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Newhills	Stoneywood School-room	11	..	..	..	11	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Paisley	School of Art	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Sessional School	44	..	..	..	..	..	..	..	..	..	..	..	..	..	44	..	..	..	..	..	..	..	..	..
Perth	Sessional School	9	4	2	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rothesay	Thomson Institution	6	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
St. Andrews	Madras College	63	..	44	..	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stirling	Science and Art School	18	18	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tarbat	Parochial School	34	..	..	..	28	..	..	..	..	..	..	..	34	..	20	20	..	..	..	..	18	..	..	34
	IRELAND.																								
Aghnagar	National School	25	..	..	..	..	..	..	..	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	25
Ahoghill	National School	20	..	..	..	..	..	..	..	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Anahilt	Endowed Free School	15	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	15
Antrim	Male National School } Main St. National School } Ladyhill National School }	70	..	..	..	10	..	..	..	..	28	..	..	12	..	14	..	..	..	..	..	..	..	..	30

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Ardara	Female National School	15	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15
Armagh	Gosford Place National School.	63	..	..	..	20	..	..	..	63	63	..	..	40	..	19	..	..	..	..	..	..	..	..	23
"	College Street School	30	..	..	..	..	..	..	..	30	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..
Athlacca	National School	18	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Athlone	St. Mary's School	34	..	..	..	..	..	..	..	16	12	..	..	25	..	22	..	..	..	..	..	..	..	25	..
"	Ranelagh School	26	17	..	..	25	..	19	..	21	21	..	..	25	..	25	25	..	..	..	..	..	..	..	..
"	Anchorsbower National School.	56	..	..	..	22	..	..	..	40	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Athy	Town Hall	32	..	..	..	..	..	..	..	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Aughnacloy	Court House	49	..	..	..	..	..	..	..	49	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bagenalstown	National School	30	..	..	..	23	9	23	..	30	30	..	..	..	..	9	..	..	..	..	..	..	..	..	..
Bailieboro'	Model School	122	..	..	..	30	..	..	..	..	122	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballee	National School	19	..	..	..	..	..	..	..	17	11	..	..	..	..	..	..	..	..	..	..	..	..	..	11
Ballincollig	National School	15	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballybay	National School	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15
Ballybofey	Town Hall	36	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	36
Ballymena	Model School	15	..	..	..	15	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Guy's National School	14	..	..	..	..	..	..	..	14	14	..	..	..	..	10	..	..	..	..	..	..	..	..	..
"	National School	10	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Harryville National School	12	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Crebilly National School	6	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballymoney	Town Hall	23	..	..	..	10	..	..	..	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	28
Ballynahinch	National School	13	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	18
"	Town Hall	10	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10
Ballyvicknakelly	National School	10	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	10
Ballywalter	Park School	36	..	..	..	..	..	..	..	..	16	..	..	18	..	20	..	..	..	..	..	..	..	..	..
Ballywilly	National School	14	..	..	..	12	..	..	..	14	14	..	..	..	..	10	..	..	..	..	..	..	..	..	14

Balyna -	- National School - -	27	..	..	..	..	..	..	..	..	27	..	..	27	..	5	..	..	..	..	..	..	..	..	..
Bandon -	- Allin Institution - -	50	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	45
Bangor -	- Endowed School - -	16	..	..	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..
Barnesmore -	- National School - -	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	18
Belfast -	- Fisherwick Place School -	71	..	..	..	22	..	10	..	9	9	..	..	..	..	24	..	..	..	..	..	..	..	..	31
" -	- Frederick Street National School.	36	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	36
" -	- Wellington Academy -	32	..	..	..	31	..	20	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	- Victoria Place School -	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	50
" -	- Northumberland Street National School.	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
" -	- Union Place National School	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..
" -	- Conway Street National School.	22	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	- Model School - - -	60	29	29	29	59	..	40	..	40	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	- Academy Street, No. 1, National School.	54	..	..	..	..	..	..	..	32	42	..	..	23	..	9	..	..	..	..	..	..	..	..	..
		20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
" -	- Linfield Road National School.	35	..	..	..	..	..	..	..	..	..	..	..	35	..	..	..	..	..	..	..	..	..	..	..
" -	- Brown Street National School.	56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	56
" -	- Nelson Street National School.	34	..	..	..	26	..	..	..	28	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	- People's Literary Institution.	27	..	11	11	9	..	5	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11	10
" -	- May Street National School	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15
" -	- Mercantile Academy -	35	..	..	..	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	- Bridge End National School	10	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	- New Road Street National School.	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	23
" -	- Townsend Street National School.	60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	60
" -	- Albion Street National School.	16	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16
" -	- Canning Street Academy -	44	..	..	..	..	..	..	..	..	36	..	..	..	..	..	..	..	..	..	..	..	..	..	18
" -	- Tennent Street National School.	12	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Belfast -	- Clarence Place Hall - -	12	..	..	..	9	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Boragh -	- Loan Fund Office - -	16	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bessbrook -	- School House - - -	10	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bonecastle -	- National School - -	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10
Bornafea -	- National School - -	9	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bruckless -	- National School - -	30	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30
Bushmills -	- National School - -	22	..	..	..	..	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Caledon -	- School House - - -	10	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Callan - -	Academy - - -	26	..	..	..	..	..	26	..	..	26	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Carlow - -	Christian School - -	28	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Carrickfergus -	Model School - - -	42	..	..	..	13	..	..	..	..	9	..	..	..	..	.	..	..	..	..	..	7	6	..	35
Castleblaney -	Annayallo National School	12	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Castlederg - -	Edward's School - -	26	..	..	..	21	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	25
Castlewellan -	Annsboro' National School -	15	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cloncore - -	National School - -	10	..	..	..	2	..	..	..	10	2	..	..	..	..	2	..	..	..	..	..	..	..	..	2
„ - -	Eglish National School -	12	..	..	..	6	..	..	..	12	3	..	..	..	..	4	..	..	..	..	..	..	..	..	12
Clonmel - -	Model School - - -	32	..	..	..	32	..	..	..	..	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	Mechanics' Institution -	12	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Coal Island - -	Infant School - - -	31	..	..	..	..	..	..	..	..	31	..	..	..	..	..	..	..	..	..	..	..	..	..	31
Coleraine - -	Model School - - -	48	..	..	..	..	..	..	..	..	39	..	..	..	..	..	..	..	..	..	..	..	..	..	16
Comber - -	Smyth's National School -	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	Lisbarnet National School -	20	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..
Connor - -	National School - -	13	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cooraclare - -	National School - -	40	..	..	..	37	..	..	..	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	40
Cork - - -	Central Model School -	37	..	..	..	32	..	..	..	34	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..
„ - - -	Carmichael National School	65	..	..	..	28	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	58
„ - - -	St. Nicholas National School	59	..	..	..	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	59
„ - - -	School of Art - - -	12	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cormeen - -	National School - -	22	..	..	..	..	..	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	22
Cottown - -	National School - -	35	..	..	..	..	..	..	..	33	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Crossgar - -	National School - -	18	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cullybackey -	National School - -	73	..	..	..	..	..	..	..	73	73	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ -	Teesham National School -	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	35
Derrygonnelly -	Lisdad National School -	81	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	80
Derrylin - -	Kinawley National School -	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Donaghadee - -	National School - -	43	..	..	..	..	..	..	..	43	..	..	..	..	..	43	..	..	..	..	..	..	..	..	..

"	Shore Street National Sch.	20	..	..	..	..	..	..	..	18	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Donoughmore	Lecture Room	7	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	6
Downpatrick	John Street National School	40	..	..	..	12	..	..	..	31	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Drogheda	St. Mary's National School	16	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dromara	Court House	14	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	14
Dromore	Corbally National School	14	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Drumaviah	National School	43	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	43
Drumlough	National School	12	..	..	..	..	..	..	..	12	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Dublin	Central Model School	199	..	15	17	..	..	..	..	169	..	..	..	..	..	..	..	..	..	..	..	..	..	..	28
"	55, Aungier Street	20	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8	..	..	12
"	Methodist School	30	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Young Men's Christian Association.	12	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Dundalk	Free Library																								
"	Educational Institution	95	20	32	32	47	..	4	..	27	37	40	..	..	..	..	..	..	..	..	..	31	..	..	40
"	Quay Street School																								
"	Jocelyn Street																								
Dundrod	National School	28	..	..	..	8	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dundrum	Endowed School	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	24	..	..	..
Dungannon	Parochial School	30	..	..	..	..	..	..	..	3	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Dungiven	National School	12	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dunmanway	Chapel School-house	64	..	..	..	64	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Reenoscrena National School	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ederney	Moneyvriece and Aghaghaffart National School.	14	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Enniskillen	Model National School	50	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Rossdoney National School	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21
Galway	Model School	18	..	..	..	18	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gilford	National School	38	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	37
Grange O'Neilland	Parochial School	16	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16
Grey Abbey	National School	20	..	..	..	12	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Hillsborough	Boys' School	30	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30
Holywood	Sullivan's Sch. and Acad.	78	..	..	..	26	..	..	..	..	50	50	..	..	..	45	..	..	..	..	..	..	..	..	60
Kilkee	National School	43	..	..	..	43	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kilkenny	Model School	56	..	..	..	15	..	..	..	..	37	..	..	..	..	..	..	..	..	..	..	..	..	..	56
"	Model Farm																								
"	Pocock Institution	31	..	..	..	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	31
Killinchy	Schoolroom	30	..	..	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..
Killybegs	National School	28	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	28
Killylea	School House	24	..	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kilmihil	Leitrim National School	13	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10
Kilmore	School	20	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Kircubbin	National School	13	..	..	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	13

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Kircubbin	Glastry National School	26	..	..	..	..	..	..	..	..	..	..	..	26	..	26	..	..	..	..	..	..	..	..	..
Larne	Model Agricultural School	29	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..	..	16
Larne and Inver	National School	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..
Letterkenny	National School	38	..	..	..	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7
Ligoniel	Wolfhill Mill	17	..	..	..	..	..	..	..	5	15	..	..	..	..	17	..	..	..	..	..	..	..	..	..
Limerick	Athenæum	14	9	3	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lisnagry	Ahane National School	15	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Londonderry	Model School	51	..	..	..	14	..	..	..	47	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Gwyn's Institution	26	..	..	..	..	..	..	..	26	..	..	..	..	..	26	..	..	..	..	..	..	..	..	26
Lough Cutra	National School	8	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lurgan	Model School																								
"	Mechanics' Institution	45	..	..	..	30	..	..	..	..	42	..	..	..	..	..	..	..	..	..	..	..	..	..	28
"	National School																								
Macroom	National School	22	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Magherafelt	No. 2 National School	43	..	..	..	..	..	..	..	..	43	..	..	..	..	43	..	..	..	..	..	..	..	..	..
Manorhamilton	Court House	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Markethill	Coolmalish National School	14	..	..	..	6	..	..	..	7	7	..	..	..	..	8	..	..	..	..	..	..	..	..	14
Millisle	National School	10	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..
Millstreet	National School	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30
"	Cullin National School	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	40
Monaghan	Model School	52	..	..	..	..	..	..	..	33	33	51	..	..	..	..	..	..	..	..	..	..	..	..	51
"	Corcaghan National School	28	..	..	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Aghnalogh National School	20	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Moy	National School	13	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Moira	Brookfield Agricultural School.	20	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Moyasta-Kilrush	National School	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Mullinavatt -	Class Room - - -	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..
Newry - -	Model School - - -	104	..	..	..	..	..	..	..	..	104	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	Cloughoge National School	29	..	..	..	29	..	..	..	29	29	..	..	..	..	29	..	..	..	..	..	..	..	..	92
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„ -	No. 2 National School -	26	..	..	..	10	..	..	..	..	..	..	..	18	..	20	..	..	..	..	..	..	..	..	..
„ -	Ballyblack Schoolroom -	22	..	..	..	..	..	..	..	..	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..
„ -	Loughriescous National School.	42	..	..	..	..	..	..	..	..	..	..	..	42	..	..	..	..	..	..	..	..	..	..	..
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Newtown Stewart -	Model School - - -	24	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ -	Lower Langfield National School.	22	..	..	..	..	..	..	..	..	..	..	..	22	..	..	..	..	..	..	..	..	..	..	22
Oldcastle - -	Endowed School - -	140	..	..	..	37	..	..	..	..	..	..	..	..	..	..	..	60	..	..	..	..	..	..	80
Omagh - -	Model School - -	49	..	..	..	28	..	..	..	30	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..
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„ -	Young Men's Christian Association.	11	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11
Portadown - -	Edenderry National School	15	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10
„ - -	Baptist Meeting House -	15	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	10
„ - -	Temperance Hall - -	6	..	..	..	5	..	..	..	5	5	..	..	..	..	1	..	..	..	..	..	..	..	..	5
Portaferry - -	No. 1 National School -	39	..	..	..	39	..	..	..	..	39	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ - -	No. 2 National School -	21	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ramelton - -	Robertson's National School	15	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Raphoe - -	National School - -	17	..	..	..	14	..	..	..	17	..	..	..	..	..	17	..	..	..	..	..	..	..	..	17
„ - -	Convoy Concert Hall -	10	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
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Rich Hill - -	Ballynahinch National School.	13	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
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Roslea - -	Greaghawarren National School. } Deerpark „ „ }	25	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„ - -																									
Santry - -	Training School - -	63	..	..	..	40	20	20	..	40	40	..	..	..	..	40	..	..	40	..	..	20	20	..	40
Scariff - -	National School - -	32	..	..	..	24	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
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Skibbereen - -	National School - -	10	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sligo - - -	St. John's National School -	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
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Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Strabane - -	Tullywhisker National School.	7	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Parish School - -	30	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Town Hall - - -	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	31
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Trim - - -	Model School - -	60	..	..	..	..	..	..	..	..	..	..	..	..	..	60	..	..	..	..	..	..	..	..	60
Tulla - - -	National School - -	12	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
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Waterford -	Model School - -	49	..	..	..	22	..	..	..	43	..	..	..	31	..	..	..	..	..	..	..	..	..	..	..
" - -	Newtown School -	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..
Total number of Classes -		2,204	257	247	226	221	6	57	47	134	170	191	22	64	8	220	8	27	14	4	7	22	8	25	219
" " Students -		29,956	6,413	6,338	{ 49* 5374 }	5,073	83	1,064	1,345	3,306	4,584	5,182	873	1,643	135	6,131	151	717	310	40	74	536	349	900	7,034
810 Schools.																									

* Naval Architecture.

INDEX.

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SCIENCE AND ART DEPARTMENT
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SOUTH KENSINGTON.

DIRECTORY,

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23rd EDITION.

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CONTENTS.

SCIENCE AND ART DEPARTMENT
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SOUTH KENSINGTON.

ESTABLISHED in connexion with the Board of Trade in March 1853 as a development of the Department of Practical Art, which in 1852 had been created for the re-organization of the Schools of Design. Placed under the direction of the Committee of Council on Education in 1856.

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Assistant Clerks.—W. H. F. Stratton; C. G. Quinton.
Accountant.—A. L. Simkins.
Book-keeper.—T. A. Bowler; *Assistant Book-keeper.*—E. Harris.

GENERAL STORES.

Storekeeper.—W. G. Groser. *Deputy.*—H. Lloyd.
Clerks.—N. Robinson; J. Smith.

SCIENCE DIVISION.

Official Inspector for Science.—Capt. Donnelly, R.E.
Occasional Inspectors.—F. J. Sidney, LL.D.; Capt. Harris, E.I.C. (*Navigation*).
Official Examiner.—G. C. T. Bartley.
Supplementary Assistant Examiner.—T. Healey.

Professional Examiners for Science.

Subject.
I.—Practical, plane, and solid Geometry.—F. A. Bradley.
II.—Machine Construction and Drawing.—W. C. Unwin, B.Sc.
III.—Building Construction.—Colonel Wray, R.E.
III. (Alternative).—Naval Architecture.—W. B. Baskcomb.
IV. } Pure Mathematics { Rev. B. M. Cowie, B.D.
V. } { T. A. Hirst, F.R.S.
VI.—Theoretical Mechanics.—Rev. John F. Twisden, M.A.
VII.—Applied Mechanics.—J. Anderson, C.E.
VIII.—Acoustics, Light, and Heat.—J. Tyndall, LL.D., F.R.S.
IX.—Magnetism and Electricity.—J. Tyndall, LL.D., F.R.S.
X.—Inorganic Chemistry.—E. Frankland, D.C.L., Ph.D., F.R.S.
XI.—Organic Chemistry.—E. Frankland, D.C.L., Ph.D., F.R.S.
XII.—Geology.—A. C. Ramsay, LL.D., F.R.S.
XIII.—Mineralogy.—W. W. Smyth, M.A., F.R.S.
XIV.—Animal Physiology.—T. H. Huxley, LL.D., F.R.S.
XV.—Zoology.—T. H. Huxley, LL.D., F.R.S.
XVI.—Vegetable Anatomy and Physiology.—T. Thomson, M.D., F.R.S.
XVII.—Systematic and Economic Botany.—T. Thomson, M.D., F.R.S.
XVIII.—Mining.—W. W. Smyth, M.A., F.R.S.
XIX.—Metallurgy.—J. Percy, M.D., F.R.S.
XX.—Navigation.—Rev. J. Woolley, LL.D.
XXI.—Nautical Astronomy.—Rev. J. Woolley, LL.D.
XXII.—Steam.—T. M. Goodeve, M.A.
XXIII.—Physical Geography.—D. T. Ansted, M.A., F.R.S.

ART DIVISION.

Inspector-General for Art.—Richard Redgrave, R.A.
Official Inspector for Art.—H. A. Bowler.
Occasional Inspectors.—S. A. Hart, R.A.; Eyre Crowe; F. B. Barwell.
Official Examiner.—E. P. Bartlett.
Professional Examiners.—Sir F. Grant, P.R.A.; Sir M. Digby Wyatt; J. C. Horsley, R.A.; R. Westmacott, R.A.; R. Redgrave, R.A.; F. Leighton, R.A.; F. R. Pickersgill, R.A.; C. W. Cope, R.A.; E. J. Poynter, A.R.A.; J. Marshall F.R.S., F.R.C.S.; James Fergusson, F.R.S.
Occasional Examiners.—Rev. J. H. Edgar, M.A.; G. M. Atkinson; G. R. Redgrave.

Inspectors of Local Schools of Science and Art.—R. G. Wylde; J. F. Iselin, M.A.

Organising Master.—J. C. Buckmaster, F.C.S.

South Kensington Museum.

General Superintendent.—Henry Cole, C.B.
Museum Superintendents.—R. A. Thompson; P. Cunliffe Owen; Capt. B. R. Festing, R.E.
Director of New Buildings.—Lieut.-Col. Scott, R.E.
Decorative Artists.—J. Gamble; R. Townroe; F. W. Moody.
Editor of Catalogues and Referee for Libraries.—J. H. Pollen, M.A., late Fellow of Merton College, Oxford.
Museum Keeper (Art Collections).—G. Wallis.
Museum Keeper (National Art Library).—R. H. Soden Smith, M.A., Trinity College, Dublin, F.S.A.
Museum Keeper (Educational Library and Collections).—A. C. King, F.S.A.
Assistant Museum Keepers.—W. Matchwick, F.L.S.; H. Sandham; R. Laskey; C. B. Worsnop; R. F. Sketchley, B.A., Exeter College, Oxford; H. E. Acton; J. W. Appell, Ph.D.; T. Clack; J. Barrett, B.A.; C. H. Derby, B.A.
Provisional Assistant Keeper.—C. T. Townshend.
Museum Clerks.—M. Webb; H. M. Cundall; C. J. Dullea.
Supplementary Clerks.—H. Vernon; A. Masson; W. E. Streatfeild; F. Coles; W. G. Johnson; G. H. Wallis.
Superintendent of the Naval Museum.—C. W. Merrifield, F.R.S.
Superintendent for Sale of Examples and Publications.—J. Cundall.

National Art Training School.

Head Master.—Richard Burchett.
Deputy Head Master.—R. W. Herman.
Mechanical and Architectural Drawing.—H. B. Hagreen.
Geometry and Perspective.—E. S. Burchett.
Painting, Freehand Drawing of Ornament, &c., the Figure and Anatomy, and Ornamental Design.—R. Burchett; R. W. Herman; W. Denby; R. Collinson; C. P. Slocombe.
Modelling.—F. M. Miller.
Lady Superintendent of Female Students.—Miss Trulock.
Female Teachers.—Mrs. S. E. Casabianca; Miss Channon.
Lecturer on Anatomy.—J. Marshall, F.R.S., F.R.C.S.

Royal School of Naval Architecture and Marine Engineering.

Inspector-General.—Rev. J. Woolley, LL.D.
Principal.—C. W. Merrifield, F.R.S.
Vice-Principal (acting).—J. H. Cotterill, M.A.
Instructor in Naval Drawing.—W. B. Baskcomb.
Instructor in Applied Mathematics and Mechanics.—J. H. Cotterill, M.A.
Instructor in Engineering Drawing.—J. Maxton.
Instructor in Marine Engineering.—W. Cawthorne Unwin, B.Sc.
Instructor in Practical Chemistry.—J. Davidson.
Instructor in French.—J. Penon.

GEOLOGICAL SURVEY.

Director-General.—Sir R. I. Murchison, Bart., K.C.B., LL.D., F.R.S.
Director for England and Wales.—A. C. Ramsay, LL.D., F.R.S.
Director for Ireland.—E. Hull, F.R.S.
Director for Scotland.—A. Geikie, F.R.S.
Naturalist.—T. H. Huxley, LL.D., F.R.S.
Palæontologist.—R. Etheridge.

ROYAL SCHOOL OF MINES.

Director.—Sir R. I. Murchison, Bart., K.C.B., LL.D., F.R.S.
Keeper of Mining Records.—Robert Hunt, F.R.S.
Assistants.—Richard Meade, James B. Jordan.
Registrar, Curator, and Librarian.—T. Reeks.
Assistant Librarian.—T. Newton.
Assistant Curator.—F. W. Rudler.

Professors.

Chemistry.—Edward Frankland, Ph.D., F.R.S.
Natural History.—T. H. Huxley, LL.D., F.R.S.
Physics.—F. Guthrie, B.A., Ph.D.
Applied Mechanics.—T. M. Goodeve, M.A.
Metallurgy.—J. Percy, M.D., F.R.S.
Geology.—A. C. Ramsay, LL.D., F.R.S.
Mining and Mineralogy.—W. W. Smyth, M.A., F.R.S.
Mechanical Drawing.—Rev. J. H. Edgar, M.A.

Museum open every day but Friday, except from the 10th of August to the 10th of September.

EDINBURGH MUSEUM OF SCIENCE AND ART.

Director.—Professor T. C. Archer, F.R.S.E.
Keeper of Natural History Museum (vacant).
Curator.—Alexander Galletly.
Assistant in Natural History Museum.—J. Davies.
Assistant in Industrial Museum.—J. Paton.
Clerks.—J. Gibson; W. Clark.

ROYAL COLLEGE OF SCIENCE, DUBLIN.

Dean of Faculty.—Sir R. Kane, F.R.S.
Secretary.—F. J. Sidney, LL.D.
Curator of Museum.—A. Gages.
Clerk.—G. C. Penny.

Professors.

Physics.—W. Barker, M.D.
Chemistry.—W. K. Sullivan, Ph.D.
Applied Chemistry.—R. Galloway.
Geology.—E. Hull, M.A., F.R.S.
Applied Mathematics.—Robert Ball, M.A.
Botany.—W. T. Thiselton Dyer, B.A.
Zoology.—R. H. Traquair, M.D.
Agriculture.—E. W. Davy, M.B.
Descriptive Geometry and Drawing.—Thomas F. Pigot.
Mining and Mineralogy.—J. P. O'Reilly.
Demonstrator in Palæontology.—W. H. Baily, F.L.S.
Assistant Chemist.—W. Plunkett.

ROYAL DUBLIN SOCIETY.

President.—His Excellency the Lord Lieutenant.
Secretaries.—G. W. Maunsell, A.M.; Lawrence Waldron, D.L.
Registrar and Assistant Secretary.—W. E. Steele, M.D.
Treasurer, &c.—H. C. White.
Director of Natural History Museum.—A. Carte, M.D.
Keeper of Minerals.—Dr. J. Emerson Reynolds.
Librarian.—E. R. P. Collis.
Temporary Assistant.—H. W. D. Dunlop.
Director of Botanic Gardens, Glasnevin.—D. Moore, Ph.D.

ZOOLOGICAL GARDENS, DUBLIN.

Secretaries.—Professor M'Dowel, M.D.; Rev. S. Haughton, M.D., F.R.S.

INTRODUCTION.

The following introduction gives a general outline of the action of the Department, and has been prepared to enable those who wish to establish a Science School or Class the more readily to understand the detailed rules and regulations under which the aid of the Department is administered.

1. In order to place a Science school or class in connexion with the Science and Art Department, an approved committee, consisting of at least five well-known and responsible persons must be formed. (*See* Science Directory, §§ X. to XVI., pp. 4 to 6.) **Local committees.**

2. The list of Science subjects towards instruction in which aid is given by the Department will be found at p. 3. **Subjects of instruction.**

3. The aid is given in the form of—Public examinations, in which Queen's Medals and Queen's Prizes are awarded, held at all places complying with certain conditions; payments on results as tested by these examinations; scholarships and exhibitions; building grants; grants towards the purchase of apparatus, &c. **Nature of aid.**

4. The Examinations are held about the month of May under the superintendence of the local committees. The examination papers are prepared by the professional examiners in London. An evening is set apart for one or more subjects, so that the examination in each subject is simultaneous over the whole kingdom. (*See* Science Directory, § XVIII., p. 7.) **Examinations, when and how held.**

5. A packet of Examination papers is sent to each local secretary, who opens it in the presence of the committee and candidates. The committee is held responsible that no unfair means of any description are used in working the papers, and that the rules of the Department are strictly complied with. (*See* Science Directory, § XXII., p. 8, and Appendix A., Science Form No. 91, p. 42.) **Examination papers how sent and worked.**

Class examinations.

6. The examinations are of two kinds, but held together (*See* Science Directory, § XVIII., p. 7), viz.:

a. The class examinations, of which there are two grades or stages; the first stage or elementary examination, and the second stage or advanced examination. The successful candidates in both stages are divided into 1st and 2nd class.

For Honours.

b. The honours examination of a highly advanced character. In this there are also two classes.

Any person however taught may sit at any one of these examinations. (*See* Science Directory, § XXIX., p. 10.)

Medals.

7. Four medals, one gold, one silver, and two bronze, are given in each subject in competition in the class examinations among the students. (*See* Science Directory, § XXXII., p. 11.)

Prizes.

8. Queen's prizes consisting of books or instruments are also given to all candidates successful in obtaining a first class in either stage of the class examinations. (*See* Science Directory, § XXX., p. 11.)

Payments on Results.

9. Payments are made either to the Committees or to the Teachers on the results of the May examination.

Amount and conditions of payment.

10. These payments are made only on account of the instruction of students of the industrial classes, or on account of the instruction of their children. (For a definition of the Industrial Classes *see* Science Directory, § XXXVI., p. 13.) They are—2*l.* for a first class, and 1*l.* for a second class, in each stage. (*See* Science Directory, §§ XXXVII. and XXXVIII., p. 14.) *Special payments are also made for Chemistry* (*See* §§ XXXIX. and LXIII.), and in certain cases also for "honours." The teacher must have given each student 25 lessons at least. (*See* Science Directory, § XXXV., p. 13.)

Qualification.

11. Any person may qualify himself or herself to earn payments on results, by obtaining a first or second class in the advanced grade of the class examination, or by taking honours.

This examination is dispensed with when the candidate has taken a degree at one of the Universities of the United Kingdom. (*See* Science Directory, § XXXIV., p. 13.)

12. To assist in the instruction of deserving students, aid is given in the creation of two forms of scholarship in connexion with elementary schools. Scholarships.

a. In the *Elementary School Scholarship* 5*l*. are granted to the managers of any elementary school for the support of a deserving pupil selected by competition, if they undertake to support him for a year and subscribe 5*l*. for that purpose. The payment of 5*l*. by the Science and Art Department is conditional on the scholar passing in some branch of science at the next May examination. (*See* Science Directory, §§ XLVI. and XLVIII., pp. 18 and 19.) Elementary school scholarship.

b. In the *Science and Art Scholarship*, which is of a more advanced character, a similar contribution of 5*l*. is required on the part of the locality, and a grant of 10*l*. is made by the Department towards the maintenance, for one year, of the most deserving pupil or pupils in elementary schools who have passed certain examinations in science and in drawing. (*See* Science Directory, §§ XLVI. and XLIX., pp. 18 and 19.) Science and Art scholarship.

In both these cases the scholar must be from 12 to 16 years of age, and one scholarship is allowed per 100 pupils in the school. Thus a school with 50 pupils may have one scholarship, a school with 150 pupils two scholarships.

13. There are also two forms of Exhibitions. These are:— Exhibitions.

a. *Local Exhibitions* to enable students to complete their education at some college or school where scientific instruction of an advanced character may be obtained. Grants of 25*l*. per annum, for one, two, or three years are made for this purpose when the locality raises a like sum by voluntary subscriptions. And Local exhibition.

if the student attend a State school, such as the Royal School of Mines in London, the Royal College of Chemistry in London, or Royal College of Science in Ireland, the fees are remitted. The exhibition must be awarded in competition. (*See* Science Directory, §§ XLVII. and LI., pp. 19 and 20.)

Royal exhibition. *b. Royal Exhibitions* of the value of 50*l.* per annum tenable for three years, to the Royal School of Mines, London, and the Royal College of Science, Dublin, are given in competition at the May examinations. Six are awarded each year—three to each institution. Free admissions are also given to all gold medallists. (*See* Science Directory, §§ LII. and LIII., pp. 21 and 22.)

Whitworth Scholarships. 14. Besides these, the *Whitworth Scholarships* of the value of 100*l.* per annum, tenable for three years, are also given in competition at the May examinations. (*See* Science Directory, § LIV., p. 23.)

Building grant. 15. A grant in aid of a new building, or for the adaptation of an existing building, for a School of Science may be made at a rate not exceeding 2*s.* 6*d.* per square foot of internal area, up to a maximum of 500*l.* for any one school, provided that certain conditions are complied with and that the school be built under the Public Libraries and Museums Act, or be built in connexion with a School of Art, aided by a Department building grant. (*See* Science Directory, § LV., p. 23.)

Apparatus grant. 16. A grant towards the purchase of apparatus, diagrams, &c., of 50 per cent. of the cost of them is made to Science Schools. (*See* Science Directory, §§ LVI. to LXII., pp. 24 to 26.) Grant for apparatus in a laboratory. *And where a school is furnished with a laboratory, properly fitted up, a payment of* 1*l. is made towards the expenses of each student who during the year receives* 25 *lessons in laboratory practice.* (*See* Science Directory, § LXIII.)

SCIENCE DIRECTORY,

Revised to August 1870.

Showing the NATURE and AMOUNT of ASSISTANCE afforded by and through the SCIENCE AND ART DEPARTMENT to INSTRUCTION in SCIENCE.

[The Rules in the present Edition supersede those in all former Editions, but are always subject to Revision. ***Important Alterations made since the last edition of the Directory are printed in Italics.*****]**

SCIENCE DIRECTORY,

Containing the Detailed Rules and Regulations under which Aid to Science Schools and Classes is administered.

Parliamentary vote.

I. A sum of money is voted annually by Parliament for scientific instruction in the United Kingdom, and is administered by the Science and Art Department.

Heads of the Department.

II. The head of the Education Department, of which the Science and Art Department is a branch, is the Lord President of the Council, assisted by a member of the Privy Council, who is called the Vice-President of the Committee on Education, and who acts under the direction of the Lord President, and for him in his absence. (Order in Council, 25th February 1856, Act 19 & 20 Vict. c. 116.)

Object of the grant.

III. The object of the grant is to promote instruction in Science especially among the industrial classes, by affording a limited and partial aid or stimulus towards the founding and maintenance of Science schools and classes.

Grant liable to be withdrawn.

IV. The amount is liable to be decreased and eventually withdrawn. Payments to teachers therefore must not be looked upon as perpetual, or in any way conferring on the teacher a claim to any payments beyond those offered from time to time.

Payment of Fees by Students.

V. The payment of fees by the students can be looked upon as the only solid and sufficient basis on which a self-supporting system can be established and supported. Though my Lords do not consider it necessary at present to lay down any rules making the payment of fees an absolute condition of the grants on account of Science instruction, yet as the payments from the State must be expected to diminish, and as aid on account of those persons who do nothing for themselves cannot be justified, Committees of schools and classes and teachers are strongly urged (should it at present not be the prac-

tice) at once to impose as high a scale of fees as they consider can be raised not only on middle class students but also on artisans.

VI. The following are the Sciences towards instruction in which aid is given:— **List of Science subjects.**

Subject 1, Practical Plane and Solid Geometry.
„ 2, Machine Construction and Drawing.
„ 3, Building Construction *or* Naval Architecture and Drawing.
„ 4, } Pure Mathematics.
„ 5, }
„ 6, Theoretical Mechanics.
„ 7, Applied Mechanics.
„ 8, Acoustics, Light, and Heat.
„ 9, Magnetism and Electricity.
„ 10, Inorganic Chemistry.
„ 11, Organic Chemistry.
„ 12, Geology.
„ 13, Mineralogy.
„ 14, Animal Physiology.
„ 15, Zoology.*
„ 16, Vegetable Anatomy and Physiology.
„ 17, Systematic and Economic Botany.
„ 18, Principles of Mining.
„ 19, Metallurgy.
„ 20, Navigation.
„ 21, Nautical Astronomy.
„ 22, Steam.
„ 23, Physical Geography.

NOTE.—*The nature of the aid given towards instruction in Art is fully explained in the* Art Directory. *The 2nd Grade examination in Art is held at the same time as in the Sciences above named.* (*See* § XVIII.)

VII. The assistance granted by the Science and Art Department is in the form of— **Nature of assistance.**

1. Public examinations, in which Queen's Medals and Queen's Prizes are awarded, held at all places complying with certain conditions.

* No candidate will be passed in Zoology unless at the same or at a previous examination he has passed in the elementary stage of Animal Physiology. (See *Appendix B.*, p. 109.)

2. Payments on results to Committees or teachers.
3. Scholarships and Exhibitions.
4. Building Grants.
5. Grants towards the purchase of apparatus, &c.
6. Supplementary grants in certain subjects, and special aid to teachers and students.

NOTE.—As respects all grants and awards, the Department is the sole judge, and cannot enter into correspondence respecting its decisions.

School Premises.

VIII. Suitable premises, both for the class instruction and also for the examination, with firing, lighting, &c., must be found and maintained at the cost of the locality where the school or class is held. If at any time the funds do not cover these requisite local expenses, it must be inferred that there is no such demand for instruction in the locality as the Government is justified in aiding; and the assistance of the Department will be withdrawn.

IX. A school or class receiving aid from the Science and Art Department must be at all times open to the visit and inspection of its officers.

LOCAL COMMITTEES.

Constitution of Local Committee.

X. Every Science School or Class must be under the management of a Local Committee who are required to be responsible for the safe custody of all apparatus, towards the purchase of which the Department has granted aid, and to conduct the examinations according to the rules. (*See* Appendix A., Science Form No. 91, p. 42.)

The relation of the teacher to the Committee of a school or class will vary much according to the circumstances of different localities. With this and other local arrangements the Science and Art Department does not interfere, but leaves them to the locality to settle.

a. The Committee must consist of a Chairman, Secretary, and at least three other members, and must be composed entirely of well-known responsible persons of independent position who have no such personal interest in the school or class as can lay them open to the slightest suspicion of partiality. Relations and pupils of the

Teacher, persons wishing to be examined, or who are under instruction in any school or class receiving aid from the Science and Art Department, and teachers of any description having pupils who are candidates for the examinations of the Department, are not eligible as members of the Committee.

NOTE.—A gentleman whose son or daughter attends any examination of the Science and Art Department is thereby disqualified from superintending any of the examinations that year, though he may act on the Committee in other respects.

b. It is very desirable that as many persons as possible in recognised positions of public responsibility in the district, such as magistrates, municipal authorities (mayor, aldermen, or town councillors), heads of educational establishments (trustees of grammar schools, managers of National schools), clergymen, &c., should be on the Committee, and it is *absolutely necessary* that at least two such responsible persons should agree to act.

c. The Chairman must be a magistrate, mayor, boroughreeve, provost, alderman, or other public officer of recognised position; trustee of grammar school, clergyman of the Established Church in parochial employment, or minister of religion in charge of a licensed place of public worship. He will have to certify that the constitution of the Committee is in accordance with the above requirements. (*See* Appendix A., Science and Art Form No. 88, p. 33.)

d. The Secretary of the Committee of the School or Class, as being the medium of communication, will carry on all correspondence with the Science and Art Department, and will be held responsible for making out and sending all returns required, for the receipt and distribution of the examination papers, the transmission of the worked papers, &c., at the proper times according to the regulations.

XI. The gentlemen who intend to act on this Committee must sign their names to a form (*write for* Science Forms Nos. 88 and 120), stating their willingness to carry out the necessary arrangements for examinations, and to observe all the regulations of the Department; each member after signing must also give his address and occupation. Care must be taken that the members who sign are properly acquainted with the duties they propose to discharge. **Formation of Local Committee.**

When a school or class is first formed, the Form No. 88 must be signed at a general meeting of the Committee. If the same Committee continue to act it will only be necessary in October to fill up Form No. 168, which expresses the willingness of the members to undertake their duties for

another year; but no one can be a member of a Committee nor assist in the conduct of an examination who has not signed Form No. 88.

Approval of, by the Department.

XII. As soon as a school or class has been established and the Committee formed, application must be made that it may be approved by the Department (*send up* Science Forms Nos. 88 and 120). No payments on account of instruction will be made unless this approval has been obtained before the 31st January preceding the examination.

N.B.—The school and class registers (see § XLII., p. 17) will not be sent until these forms, properly filled up, have been received from the school applying for them.

Committee for conducting an examination only.

XIII. A Committee may be formed for conducting the examination only of a class or school which does not receive aid from the Department in the form of payments on results. It must be approved before the 31st March (*write for* Science Form No. 88*a*).

Reimbursement of Committee.

XIV. For the clerical labour of making the necessary returns, filling up forms, &c., a grant is made to the Committee of 1*l*. This is paid after the conclusion of the examinations.

When more than two examinations are held, the sum of 10*s*. will be allowed to the Committee—or in the case of an amalgamation (*see* § XXVI., p. 9), to the amalgamated Committee—for each further examination for the expenses connected with it.

These grants will only be made provided the examinations are regularly conducted, and the returns and forms sent up in due course, as given on the Science Form No. 170. (See *Appendix A., p.* 32.)

Inspection.

XV. As often as may be necessary an Inspector of the Department will visit the school or class, and report on the condition of the premises, the constitution of the Committee, and the manner in which the regulations are carried out.

If due notice of the visit of the Inspector has been given, a meeting of the Committee must be held to receive him, at which as many of the members as possible are expected to attend. (*See* Science Form No. 170, *Appendix A.*, p. 32.)

Memoranda for Secretaries.

XVI. At page 32 in the Appendix A. will be found a table of memoranda for the use of Secretaries and

Members of Science Committees (*write for* Science Form No. 170) which it is expected will be carefully attended to.

EXAMINATIONS.

XVII. The Science and Art Department holds annually about May, through the agency of the Local Committees, public examinations in all the before-mentioned Sciences—and in Art 2nd grade—in any place in the United Kingdom which complies with the requisite conditions. (*See* §§ X. to XIII., pp. 5 and 6.) On the results of this examination payments are made for the instruction of the students, and medals and prizes are awarded. Examination of Classes.

For Navigation Classes special examinations are also held three times a year. (*See* § LXIV., p. 26.)

XVIII. The examinations are of two kinds, but are held on the same evening and conducted by the same Committee:— Examinations, how held.

a. The class examinations for students under instruction in Science Classes whether taught by teachers qualified to earn payments on results or not.

b. The honours examination, of a highly advanced character.

The 2nd grade Art examination in Freehand Drawing, Model Drawing, Practical Geometry and Perspective, is held at the same time of the year as the Science examinations. That in Freehand Drawing and Model Drawing is held on a separate evening, but that in Geometry and Perspective on the same evenings as the examination in Science Subject I., Practical, Plane, and Solid Geometry (see § VI., *p.* 3, *and Art Directory, p.* 23, *footnote* †).

XIX. The examinations in the subjects and stages bracketed together are held on the same evening; candidates can therefore be examined in one only of these subjects or stages in any one year.

II. Machine Drawing.
III. Building Construction.
XV. Zoology.

XII. Geology.
XX. Navigation.

XIII. Mineralogy.
XXI. Nautical Astronomy.

XI. Organic Chemistry.
XXII. Steam.

XVI. Vegetable Anatomy and Physiology.
XIX. Metallurgy.

XVIII. Principles of Mining.
IV. and V. Mathematics. { *Stage* 6. *Stage* 7. }

IV. and V. Mathematics. { *Stage* 1. *Stage* 2. *Stage* 3.

IV. and V. Mathematics. { *Stage* 4. *Stage* 5.

Classification of Results of examinations.

XX. For the purpose of the class examinations each subject is divided into two stages—the elementary and the advanced stage; except Mathematics, which is divided into seven stages (*see* Syllabus, p. 51). There is a different examination paper for each stage, and in each stage there are two grades of success—first and second class. For the second or lowest class of the elementary stage, the standard of attainment required is only such as will justify the Examiner in reporting that the instruction has been sound, and that the students have benefited by it; but the standard may be raised from year to year.

Honours paper.

XXI. There is an honours paper in each subject, except Mathematics, which for this purpose may be considered as divided into three subjects, an honours paper being set on each evening for the whole of the stages comprised in that evening's examination.

Application for Examination.

XXII. An application, stating in what subjects examination will be required, must be made on Science Form No. 329, and sent in before the 28th of February. A second form (Science Form No. 119) must be sent in before the 31st of March, giving the precise number of candidates to be examined in each subject.

On the 31st of March the examination lists must be finally closed, and unless these instructions have

been *strictly* adhered to no examination can be held.

The rules for the conduct of the examinations will be found on Science Form No. 91 (*see* Appendix A., p. 42). They must be carried out with the utmost strictness.

XXIII. Should there be at any time reason to suspect the fairness of the examination generally, or of the way in which particular candidates have worked their papers, a further examination will take place in such manner as may be deemed most advisable. Refusal on the part of any candidate to be re-examined will entail the cancelling of his previous examination. Re-examination.

XXIV. All possible care will be taken by the Department at the time of the examinations that papers shall be forwarded in accordance with the applications, and that the results may be correctly issued. As, however, a very large number of classes have to be dealt with, mistakes may possibly occur. The Department cannot undertake to rectify such mistakes, nor will it hold itself responsible for any loss which may in consequence accrue to individual committees, teachers, or students. Department not responsible for errors.

XXV. If no candidate comes forward for examination in one of the subjects for which examination papers have been sent, the envelope containing these papers must be returned *unopened* by the next post. Also, if two sets of examination papers in the same subject have been sent, one set must be returned unopened. This rule must be carefully attended to. Return of unrequired examination papers.

XXVI. If two or more classes in the same town, or within a reasonable distance of one another, apply for the examination of the Science and Art Department, a general examination committee must be formed by the amalgamation of the several Committees to carry out the examinations at some common centre, such as the town hall or other public building. It is only when the Inspector reports that the local circumstances are of such a character as to render an amalgamation of the Committees impracticable that it will not be insisted on. Amalgamation of Classes and Committees.

When there are not more than three candidates in one place, it will be at the discretion of the Department to allow a separate examination, or to require the candidates to go to a neighbouring centre.

Special Local Secretary.

XXVII. In large towns or populous districts where there are three or more schools, and where numerous examinations are to be held, the Science and Art Department *may at its discretion require* a Special Local Secretary to be appointed to manage the whole of the examination business. The Department will correspond with him alone on all subjects connected with the examination. He will be allowed a fee of ten guineas, and an extra fee of half a guinea for each night that an examination is held.

The rule requiring an amalgamated examination to be held in some one public building (*see* § XXVI.) will be adhered to also in this case. Even where no sufficiently large public building can be obtained, or where there may be other insuperable difficulties to holding the examinations at one centre, the one Special Local Secretary must still be the one medium of communication with the Department, and will be responsible for all arrangements subject to the approval of the Science and Art Department.

Election of Special Local Secretary.

XXVIII. When the Department has directed the appointment of a Special Local Secretary, his election will rest with the Local Committees; or failing their coming to an agreement he will be nominated by the Mayor or other principal municipal authority.

The Special Local Secretary must be nominated for the approval of the Science and Art Department from year to year, before the 15th of March.

Examination of external Students.

XXIX. Besides the registered students of a class, any other person may present himself for examination before the Local Committee whenever an examination is being held for the class. Before the 26th of March he must apply to a Local Secretary, who will forward his name to the Department on Science Form No. 119, and if required by the Local Committee he will have to pay a registration fee of not more than 2*s*. 6*d*. Arrangements must therefore be made by the Local Committee, or the General Exa-

mination Committee, as the case may be, to give accommodation at the examination to all outside candidates who have given the proper notice, as well as to the students in the class for which the Committee act, to sit at the examination.

The registration fee of 2*s.* 6*d.*, which such candidates may be required to pay, is to reimburse the Committee for any extra expenses incurred by such attendance, and may at their option be reduced or remitted.

Queen's Prizes.

XXX. To all successful students are given printed lists of results showing their position; to the first class in each stage are given Queen's prizes, consisting of books or instruments chosen by the candidates from lists furnished for that purpose. (*Apply for* Science Form No. 110.)

No Queen's prize or medal will be given to a student in the advanced stage unless he have previously passed in the elementary stage, or been successful under the old system.

Candidates eligible for Prizes.

XXXI. The prizes are unlimited in number, and are open to all candidates who come within either of the following categories:—

(1) Students in Science Classes under Teachers qualified to earn payment.

(2) Registered Students in Artisan Classes taught by other Teachers.

The following are not eligible for prizes:—

a. Students who have previously received the same, or a higher class, in the same subject; and

b. Teachers earning or who have earned payments on the results of instruction. Also

c. Persons who are or have been students of the Queen's Colleges in Ireland, the Royal School of Mines, London, the Royal College of Science, Dublin, the Royal Dockyard Schools, and other institutions receiving State aid for instruction. They may, however, compete for the Whitworth and other Exhibitions and Scholarships of the Department, but they cannot take Queen's prizes and medals, except in those subjects which are not taught as a portion of the regular course in the Institutions to which they belong.

Queen's Medals.

XXXII. Four medals, one gold, one silver, and two bronze, are given in the class examination in each

subject for competition among the bonâ fide students of Science Classes who either come within the category of persons on account of whom payments can be earned, or are under 17 years of age.

Only registered students of schools and classes under Local Committees (*see* § X., p. 4) can take medals: middle class students, persons engaged in teaching, as well as teachers in training, who are more than 17 years of age, even if qualified as above, are ineligible for them. Should a student take more than one gold, silver, or bronze medal, he will receive books instead.

When the best candidates for Queen's medals are nearly equal, five or six of them, as may be found desirable, may be summoned to London for further examination in order to decide to whom the different medals shall be awarded. Their travelling expenses, second class railway fare, and 10*s. a day while required to be absent from home, will be allowed.*

Payments on Results and Qualification of Teacher.

Qualification for earning payments on results.

XXXIII. Payments are made on the results of instruction when it has been given by teachers who have qualified in either of the categories mentioned below: And no payments are made on account of instruction given in subjects in which the teacher is not so qualified.

The qualification consists in having—

a. obtained a teacher's certificate in any of the before-mentioned sciences according to the rules in force previous to January 1867; or,

b. obtained a First or Second Class in the advanced stage at the May class examinations since that date; or,

c. taken honours at the May examinations.

In Mathematics a First Class in each stage will qualify the holder to earn payments on the results of instruction in that stage, or in the preceding stages, and Honours in stages 3, 5, and 7, on the results of instruction in the preceding stages.

Teachers already qualified to earn payments in "Elementary Mathematics" (1869) are qualified in stages 1, 2, and 3, and teachers already qualified in "Higher Mathematics" (1869) are qualified in all the stages of Pure Mathematics.

Payments are made at the discretion of the Department either directly to teachers or to the Committee or managers of the school. Payments to whom made.

XXXIV. The examination for qualification to earn payments on the results of instruction will be dispensed with in the case of a candidate who has taken a degree at any University of the United Kingdom, or who has obtained the Associateship of the Royal School of Mines, London, or the Royal College of Science, Ireland. Honorary and 3rd grade Art Certificates.

Before such a candidate commences to teach, in order to earn payments on results, he must make formal application to the Department to be recognised as a Science teacher, and he must furnish full particulars of his occupation and position accompanied by his diploma or a certificate from the registrar of his University.

Teachers who previously to the 28th January 1869 have obtained Art certificates of the third grade are also qualified without further examination to earn payments on the results of their instruction in subjects I., II., and III., under the same rules and on the same conditious precisely as Science teachers. It must be clearly understood that to claim these payments the rules of the **Science Directory** must be adhered to.

XXXV. Payments are only made on condition that the student has received 25 lessons at least from the teacher or teachers in each subject in which payment is claimed since his last examination—each lesson being an attendance at a meeting of the school of at least three-quarters of an hour's duration on a separate day. The 25 lessons need not necessarily be all given in one year, but may extend over a longer period. Conditions.

It must be clearly understood that the number (25) of lessons which the teacher is required to give is the minimum fixed as a criterion that the pupil has received his instruction from the teacher. It is not meant in any way to specify that that amount of instruction is sufficient, or to guarantee the teacher's receiving payment, if that amount of instruction alone is given.

XXXVI. Payments are made to the qualified teacher on account of the instruction of students of the Industrial Classes only. Payments made for instruction of Industrial Classes.

Definition of Industrial Classes.

Under "Students of the Industrial Classes" are included:—

a. Artisans or operatives in the receipt of weekly wages.

b. Coastguards, policemen, and others who, though in receipt of weekly wages, do not support themselves by manual labour.

c. *Teachers of elementary schools in connexion with the Education Department, Whitehall, or the National Board of Education, Ireland.* (*See* Exception in § XXXVII.)

d. Persons in the receipt of salaries not large enough to render them liable to the income tax, as some descriptions of clerks, shopmen, &c.

e. Small shopkeepers employing no one but members of their own family and not assessed to the income tax.

f. Tradesmen and manufacturers on their own account, supporting themselves by their own manual labour, not employing apprentices, journeymen, &c., and not assessed to the income tax.

g. The children (not gaining their own livelihood) of all such persons above mentioned.

And no payments are made on account of any other students.

Instruction in Institutions receiving State aid.

XXXVII. No payments on the results of instruction in those branches of Science which are taught in Institutions receiving State Grants, such as the Queen's Colleges in Ireland, the Royal School of Mines, London, the Royal College of Science, Dublin, and the Royal Dockyard Schools, will be made on account of the pupils who are or have been students of those institutions.

No payments are made on account of students passing in *Stage 1 of Mathematics *or in the elementary stage of Subject XXIII., Physical Geography*, who are,—

a. Students in Training Colleges receiving State aid.

b. Teachers trained at the public expense.

Payments claimable on the results of the Class Examinations.

XXXVIII. The payments claimable for each student who has passed in either stage, in each subject are—2*l.* for a first class, and 1*l.* for a second class. Also 10*s.* for each second grade Art paper satisfactorily worked.

* So far as Mathematics are concerned, this restriction does not apply to females.

No payments are made on account of a student who has been previously successful in a higher stage of the same subject. If the student has been previously successful in the same stage of the same subject, the payment on his account is reduced by the payment which was claimable on such previous success.*

For instance, the 2*l.* payment for a first class would, if the student had previously taken a second class in the same stage, be reduced by 1*l.*

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* The deduction on account of a pupil's previous success in the examination of May 1869 or some previous year, when there were three classes in the elementary stage, will be made according to the following scale:

a. For a first class in the elementary stage—the student having previously obtained a third class—1*l.* 10*s.*

b. For a first class—the pupil having previously obtained a second class—1*l.*

c. For a second class—the pupil having previously obtained a third class—10*s.*

As respects Mathematics (Subjects IV. and V.) the arrangements with regard to the previous successes of students will be understood from the following table. The corresponding divisions of the subject under the old and new systems are given in the columns A. and B. With a previous success, therefore, as given in column A., no payment will be made on account of the corresponding success at the May 1870 examination, as given in column B.

A.	B.
ELEMENTARY MATHEMATICS, IV.	PURE MATHEMATICS.
3rd Class, First Stage - -	Stage 1.
2nd " " - -	do. and 2nd Class of Stage 2.
1st " " - -	do. and Stage 2.
2nd " Second Stage - -	Stages 1 and 2.
1st " " - -	do. do. and 2nd Class of Stage 3.
HIGHER MATHEMATICS, V.	
3rd Class, First Stage - -	Stages 1, 2, and 3.
2nd " " - -	do. do. and 2nd Class in Stage 5.
1st " " - -	do. do. and 2nd Class in Stage 6.
2nd " Second Stage - -	Stages 1, 2, 3, and 6, and 2nd Class in Stage 5.
1st " " -	do. 1, 2, 3, 5, 6, and 2nd Class in Stage 7.

Deductions are also made in payments on account of Subject I. to the amount of any payments that have been made on the Second Grade Examinations in Art, in Practical Geometry, Perspective or Mechanical Drawing.

Special payments for Chemistry.

XXXIX. In Chemistry special extra payments will be made on account of students who show a good knowledge of laboratory practice. Special questions on chemical analysis will be given in the ordinary examination paper. The knowledge of laboratory practice above stated will be shown by the student answering these questions. These payments will be 10*s. and* 1*l. extra on the second and first class respectively in both the Elementary and the Advanced Stage. They will be claimable according to the same rules and subject to the same deductions on account of previous success as the ordinary payments.*

Payments are also made towards the expenses of a student for the study of practical chemistry in a school laboratory (*see* § LXIII., page 26).

Payments claimable on the results of the Honours Examinations.

XL. On each student who passes in the First or Second class in Honours 4*l.* and 2*l.* respectively are claimable, provided the student has already passed through the elementary and advanced stages after instruction in a Science Class in connexion with the Department.

Form of Claim for Payment.

XLI. The claim for the payments must be made on Science Form No. 51, or on Art Form No. 525, as the case may be. The voucher must be signed by the secretary or chairman and two members of the Committee at least, at a meeting of the Committee held specially for the examination and certification of the claim. (*See* Science Form No. 51, Appendix A., page 39. N.B.—Many details with regard to payments will be understood from the cases given in this form.)

Teachers' travelling expenses.

Special grants for travelling expenses of teacher will be made, for one year as an experiment, but only where it is shown that there is a local organisation for a general system of Science instruction in an outlying district of villages or small towns where local teachers cannot be obtained, and where it is clearly

of advantage to have the services of a highly qualified teacher resident in the district.

Each case will be considered on its merits. A special application must be made before the commencement of the session explaining the exact circumstances of the case, and giving an estimate of the travelling expenses, second-class railway fare, &c. The Department will then decide what amount shall be allowed. This will be in the form of a certain allowance per journey on the production of the necessary vouchers and the satisfactory proof that fair work has been done.

It must be clearly understood that this gives no claim for travelling expenses generally, and no case will be considered unless the application has been received at the commencement of the session and sanctioned by the Department.

XLII. A general register must be kept for the school, and an attendance register for each class in each subject, on Forms which will be supplied on application. (*Apply for* Science Forms Nos. 139 and 139A.) These registers must be made up from day to day, and will be examined and approved by the Inspector on his visit. They must be sent to the Department with the claim for payment, and no grants will be made unless the registers are properly kept. **Registers.**

a. The Committee must keep a General Register (Science Form No. 139) of all the pupils attending the Science Classes under their supervision, in which the name, age, address, and occupation of each student must be entered. This register must be filled in by the Secretary or a member of the Committee, and not by the teacher.

b. For every class the teacher must keep a register of attendance (Science Form No. 139A), in which he will enter the presence or absence of the students at each lesson. The Committee is held responsible for the entries being correct.

c. A record must also be kept of the visits which individual members of the Committee make to the school from time to time. (*See* page 8 of Science Form No. 139.)

XLIII. All payments on account of Science teaching are made by the Science and Art Department. They are only made in respect of a school in connexion with the Department which has been **Instruction in an Elementary School.**

approved by it, and which is open at any time to the visit and inspection of its officers. No such payments are made in respect of any instruction in Science that may be given during the three attendances of an Elementary School receiving aid from the Educational Department, Whitehall.

Use of Elementary School premises.

The managers of an Elementary School under the inspection of the Education Department can permit their premises to be used for Science teaching, provided that no interference be allowed with the primary purposes of such Elementary School, or in any way with the three attendances of the Elementary School.

Examination by the Inspector.

XLIV. On the occasion of his periodical visit to the school or class, the Inspector will inquire and see how the instruction is being given, examining the pupils, if necessary, *vivâ voce*, and report if there is sufficient apparatus for the satisfactory teaching of experimental science. If the Inspector's report of any school shows that the instruction is inefficient, and that from the deficiency of proper apparatus, &c. it cannot be otherwise, the Science and Art Department may refuse to make payments on the results of the examinations.

Scholarships and Exhibitions.

Scholarships and Exhibitions.

XLV. Grants are made to aid local efforts in founding scholarships and exhibitions. The scholarship is intended to maintain the student while remaining at a day school, and the exhibition to support him while pursuing his studies at some central institution where the instruction is of a high grade.

Local Scholarships.

XLVI. There are two forms of local scholarship in connexion with elementary schools:—

(1.) The Elementary School Scholarship;
(2.) The Science and Art Scholarship.

By elementary school is understood any school where elementary instruction is given, whether aided by the State or not.

XLVII. For the encouragement of advanced scientific instruction, there are two kinds of exhibitions: Exhibitions.

(1.) The Local Exhibition.
(2.) The Royal Exhibition.

XLVIII. *Elementary School Scholarship.*—A grant of 5*l.* is made towards the maintenance of a deserving student to the managers of any elementary school who undertake to support him for one year and subscribe at least 5*l.* for that purpose. Elementary School Scholarships.

Conditions.—

a. With any number of scholars up to 100 on the register of the school there can be but one such Scholarship; above 100 and up to 200 two Scholarships, and so on for each 100. Conditions of obtaining the Elementary School Scholarships.

b. The Scholarship or Scholarships must be awarded in competition to the most successful student or students in some examination of the school. The absolute terms of the competition and the award of the Scholarship will be left to the managers of the school, subject to the approval of the Science and Art Department.

c. The scholar must be a student of the industrial class, as defined above (see § XXXVI., p. 13), and be between 12 and 16 years of age.

d. He must not be the teacher, pupil-teacher, or other paid servant of a school.

e. He must continue regularly to attend a day school, and—

f. Obtain at least a second class in the elementary stage in some one or more branches of Science at the succeeding May examination of the Science and Art Department, after which the Department grant of 5*l.* will be paid.

Application must be made for the Elementary School Scholarships before the 1st March in one year, and the Department grant will be paid after the May examination in the next year. (*Apply for* Science Forms Nos. 280, 281, 282.) Date of application and of grant.

XLIX. *The Science and Art Scholarship.*—A grant of 10*l.* is made towards the maintenance of a student at a day school who has taken a first grade in Freehand or Model Drawing and Elementary Geometry (*see* Art Directory, p. 16), and passed in one of the subjects of Science, provided that the managers of the school undertake to support him for one year and subscribe 5*l.* for that purpose. Science and Art Scholarship.

Where there is no Art Certificated Teacher the examination in drawing can be held by the Science Class Committee, to whom the necessary papers will be sent.

Conditions of obtaining the Science and Art Scholarship.

Conditions.—

a. With any number of scholars up to 100 on the register of the school there can be but one such Scholarship; above 100 and up to 200 two Scholarships, and so on for each 100 scholars.

b. The Scholarship or Scholarships will be awarded to the most successful student or students in the school.

c. The scholar must be a student of the industrial class, as defined above (*see* § XXXVI., p. 13), and be between 12 and 16 years of age.

d. He must not be the holder of an Elementary School Scholarship, the teacher, pupil-teacher, or other paid servant of a school.

e. He must continue regularly to attend a day school, and—

f. Obtain a higher class in the subject of Science in which he has already passed, or pass in some other subject.

g. In each year of holding the Scholarship he must pass either in a higher grade of the same subject or in a new subject.

Date of application and of grant.

Application for the Science and Art Scholarship must be made before the 1st March in one year; the successful competitors for the scholarship will be decided at the May examinations of that year, and the Department grant of 10*l.* will be paid after the May examination in the next year. (*Apply for* Science Forms Nos. 283, 284, 285.)

Renewal of grants for Scholarships.

L. It rests with the local managers of the scholarships—whether "Elementary School" or "Science and Art"—to determine for how many years the student may hold the scholarship, but in no case can he be allowed to hold it for more than three years.

Should the Managers wish the holder of the scholarship to pursue his studies at another school, the Department will be prepared to entertain an application for the continuance of the payment of the 5l. or 10l., provided the other conditions are still complied with, and all the circumstances reported to the Department.

Local Exhibition.

LI. *Local Exhibitions.*—The Science and Art Department will make a grant of 25*l.* per annum to the Managers of any school or educational institution, or any Local Committee formed for the purpose, who will raise the like sum by voluntary contribution for the maintenance of a student at some

college or school where a thorough course of scientific instruction of an advanced character may be obtained. The exhibition may last for one, two, or three years.

Conditions.—

a. The exhibition must be awarded in competition in one or more branches of Science at the May examination of the Science and Art Department. The managers may select any branch or branches of Science for the competition, and if more than one be taken they may fix any relative amount of marks they consider best to assign to them. **Conditions of obtaining it.**

b. The place or places where the exhibition is to be tenable and where the student is to pursue his studies may be fixed by the managers subject to the approval of the Science and Art Department, provided that the exhibitioner shall always have the option of going to one of the following institutions:—The Royal School of Mines or Royal College of Chemistry, London, or the Royal College of Science, Dublin. If either of these Government institutions be selected, the fees of the student will be remitted.

c. The exhibitioner must be a student of the industrial class, as defined above (*see* § XXXVI., p. 13).

d. The grant of the Department will be paid from year to year on condition that a like payment has been made by the managers or Local Committee, and that the student has pursued his studies satisfactorily according to regulations fixed by the Department.

The Local Exhibition must be applied for before the 1st March. (*Write for* Science Forms Nos. 286, 287, 288.) **Date of application.**

Thus, for example, a Local Exhibition which is to be competed for in May 1875 must be applied for before the 1st March 1875, and the Department grant will be given after the May examinations in 1876.

LII. *Royal Exhibitions*, of the value of 50*l.* per annum tenable for three years, to the Royal School of Mines, London, and the Royal College of Science, Dublin, are given in competition at the May examinations. **Royal Exhibitions.**

There are nine Royal Exhibitions to the Royal School of Mines, Jermyn Street, and nine to the Royal College of Science, Dublin. They are of the value of 50*l.* per annum each, and are tenable for three years. Three Exhibitions to each Institution **Competition for and conditions of holding them.**

are therefore generally vacated each year. They are competed for at the May examinations, and are held from year to year for three years, on the condition that the holder attends the lectures regularly during those years, and passes the examinations required for the associateship of the school. The Exhibitions entitle the holders to free admissions to all the lectures, and to the Chemical and Metallurgical Laboratories at those two institutions.

Persons not eligible for them.

All persons over 21 years of age, excepting artisans, and such as come within the category of persons paid upon under § XXXVI. p. 13, will be excluded from competing for the Royal Exhibitions. Special cases, however, must be determined according to the spirit of the rules, and the object of the endowment. *Candidates should register their names as competitors for Royal Exhibitions, and send in Science Form No.* 400 *before the* 25*th May.*

Calculation of results in the competition for Royal Exhibitions.

LIII. The competition for the Royal Exhibitions will be determined as follows:—

The maximum number of marks obtainable in each subject, except Mathematics, will be in the

Elementary stage	100
Advanced stage	200
Honours	400

In Mathematics the numbers will be in the

1st stage	100	
2nd "	200	
3rd "	300	Honours 500
4th "	150	
5th "	300	Honours 500
6th "	200	
7th "	400	Honours 600

But in each case the number of marks gained in the Elementary Stage (or in the 1st stage in Mathematics) will be diminished by the minimum number required to pass in that stage, and the number of marks gained in each of the other stages will be diminished by 20 per cent. of the marks obtainable in that stage.

The remainder will then be added together to determine the candidate's position.

But no candidate will be allowed to take an Exhibition who has not obtained in Mathematics at least as many marks as are required for a second class in the second stage.

Whitworth Scholarships.

LIV. *Sir Joseph Whitworth's* scholarships of the value of 100*l.* per annum, tenable for three years, are also given in competition at the May examinations. *Candidates for Whitworth Scholarships should register their names as competitors, and send in Science Form No.* 400 *before the* 25*th May.*

Full instructions as to the subjects, time, place, conditions, &c. of the competition for these scholarships are given in the **Whitworth Prospectus,** which can be had on application to the Secretary, Science and Art Department.

Building Grants.

Grants in aid of building Science Schools.

LV. A grant in aid of a new building, or for the adaptation of an existing building, for a School of Science may be made at a rate not exceeding 2*s.* 6*d.* per square foot of internal area, up to a maximum of 500*l.* for any one school, provided that the school—

a. be built under the Public Libraries Act (13 & 14 Vict. c. 65.; 18 & 19 Vict. c. 70.; 29 & 30 Vict. c. 114.), (*see* Summary of the Law relating to the establishment and maintenance of Public Libraries, &c., *Appendix A.*, p. 47); or—

b. be built in connexion with a School of Art aided by a Department building grant.

And provided that there is a population in the neighbourhood which requires a School of Science; that it is likely to be maintained in a state of efficiency; and that the site, plans, estimates, specifications, title, and trust deeds are satisfactory.

The regulations under which building grants to Schools of Science are made will be found in Appendix A., p. 49. (*Apply for* Science Form No. 349.)

Apparatus Grants.

Grants for apparatus.

LVI. A grant towards the purchase of apparatus, diagrams, &c., of 50 per cent. on the cost of them, is made to Science Schools and Classes taught by duly qualified teachers under the supervision of Committees constituted in accordance with the § X., p. 4, and approved by the Department.

If at any time it is found that the apparatus, examples, &c., towards the purchase of which a grant has been made are not properly taken care of, the aid of the Department may be withdrawn.

Grants on the same scale will also be made to schools or classes not under qualified teachers in cases where the total value of the apparatus required is not above 10*l.*

Disposal of apparatus on closing of school.

LVII. When schools or classes are closed and reported by their Committees as not likely to be reopened again, on application being made to the Science and Art Department, permission may be given for the disposal of the apparatus in their charge, towards the purchase of which aid has been given, in one of the following ways:—

1. By transfer to the Committee of some other Science School or Class, willing to accept the apparatus on the usual conditions.
2. When the apparatus has been used at least two years in the School, by its becoming the absolute property of the Committee of the school on their repaying to the Science and Art Department 50 per cent. of the amount contributed by it to the purchase of the apparatus.

Apparatus grants will only be made on the condition that Committees will transfer the apparatus, on the closing of the school, when another Committee is found willing to purchase it, and offers terms approved by the Science and Art Department.

Grants of apparatus to endowed schools.

LVIII. As a general rule no endowed school is eligible to receive a grant towards the purchase of apparatus, &c., unless considerable local contributions

are made in aid of it; and then only when the apparatus is clearly necessary.

LIX. Catalogues containing priced lists of apparatus, instruments, diagrams, books, &c. from various manufacturers have been prepared in the following sciences and can be had on application :— **Catalogues of apparatus.**

(1.) Practical Geometry, Machine and Building Construction, and Mechanics.
(2.) Experimental Physics.
(3.) Chemistry.
(4.) Geology and Mineralogy, Natural History, (Physiology, Zoology, and Botany), and Physical Geography.

These catalogues contain the highest price of each article on which the aid of 50 per cent. is given. The applicant is at liberty to select a higher priced article, but the aid towards the purchase of it will be only 50 per cent. of the highest price above mentioned. Should a lower priced article be selected the aid will only be to the extent of 50 per cent. of its price.

Schools are also permitted to select a single copy of each of the text books given in the Syllabus, towards the purchase of which similar aid will be granted.

LX. Committees requiring aid in the purchase of apparatus, &c. should apply for Science Form No. 49, and also for the catalogues referred to above. **Method of obtaining grants.**

The Committee of the School or class may select any of the manufacturers whose names are given in the catalogues.

Orders from different tradesmen must be made on separate forms.

In filling up the Form No. 49, the number of the apparatus given in the catalogue must always be mentioned.

LXI. Payments, including charge for packing, must be made in advance to the manufacturers on receipt of the invoice. The goods to be sent at the risk of the purchaser. On obtaining a receipt from the Committee of the School (which is included in the form of Requisition) that the articles have been received, the remaining 50 per cent. will be paid to the manufacturer by the Department. **Payments to manufacturers.**

Limitation of grants.

LXII. Except as provided in the next paragraph, apparatus grants are rigorously confined to articles of a non-destructible nature; hence no aid will be afforded in the purchase of breakable articles, such as glass retorts, tests tubes, &c., nor, indeed generally, in the purchase of articles to be used by the student, as distinguished from those of a permanent and illustrative character which are required by the Teacher in giving instruction in Science.

Grants are only made in the purchase of one object of the same kind. Duplicates of apparatus, &c. are not allowed at the reduced rate.

Grants in aid of students' expenses.

LXIII. A grant of 1*l. is made towards the expenses of a student in the laboratory for a year, on condition that—*

a. The School is reported to be furnished with a laboratory sufficient for the purpose and fitted up with all the apparatus given in the official list. (See Science Form No. 402, *Appendix A., p.* 45.)

b. That the student, for whom the payment is claimed, receives at least 25 *lessons of not less than one hour and a half each in laboratory practice.*

c. And, that he passes in the Elementary or in the Advanced Stage of Inorganic or Organic Chemistry.

The 1*l. payment may only be claimed twice, i.e., in two separate years, on account of the same student.*

Where two students use the same set of apparatus (see Science Form No. 402, *Appendix A., p.* 45), *the payments made on their account towards its cost will be* 15*s. each, provided the other conditions given above are complied with.*

Schools wishing to take advantage of this regulation must send in Science Form No. 420 *before the* 15*th December of each year.*

Supplementary Grants in certain Subjects, and Special Aid to Teachers and Students.

Navigation Schools.

LXIV. In addition to the ordinary science examinations in May, class examinations are held in Mathematics, Navigation, Nautical Astronomy,

Steam, and Physical Geography for the benefit of seafaring men—and for them only—three times a year in all seaports where Local Committees are formed and are willing to undertake them. These examinations take place in the beginning of March, September, and December. The application for these examinations must be made on Science Form No. 119 before the 10th day of the previous month.

These examinations are only allowed when there are at least 40 candidates for examination, and in such subjects and stages only in which there are 40 candidates in the United Kingdom.

The payments to properly qualified teachers (*see* § XXXIII., p. 12) on the results of the quarterly examinations for seamen, will be according to the same scale as that laid down for the ordinary May examinations (*see* § XXXVIII., p. 14), and the regulations with regard to Committees (*see* §§ X. to XVI., pp. 4 to 6), registers (*see* § XLII., p. 17), and number of lessons (*see* § XXXV., p. 13), must also be carried out in the case of Navigation Schools.

Special teachers' qualifications.

LXV. Teachers qualified to earn payments on results in Subject I., Practical, Plane, and Solid Geometry, are qualified to earn payments on results in the Art examinations of the 2nd Grade in Practical Geometry and Perspective. (*See* Art Directory, pp. 16 and 24.)

The 2nd Grade Art Examination in Practical Geometry and Perspective will be held at the same time as the Science Examination in Subject I. The course in the Art subjects may be considered as a preliminary stage to that in the Science subject.

Extra grants in Subjects II. and III.

LXVI. In order to encourage the artistic ability which may be shown in drawings of buildings and machines executed by students in Science classes as exercises in Subjects II. and III., grants are made to the Local Committee of the School similar to those for works executed in Art schools or classes, provided the teacher is qualified in accordance with § XXXIII. (*see* p. 12), to earn payments on the results in Subjects II. and III. The grants are as follows, viz.:—

a. A payment not exceeding 15*s.* for any one student, on account of every artisan student who shall submit satisfactory works executed in the school or class during the then current school year—

(1.) In Mechanical and Machine drawing; and,

(2.) In drawing details of Architecture from copies.

(Art Directory, p. 25, § 3*b*, and p. 36, Stage 23*a*.)

b. A payment not exceeding 20*s.* for any one student, on account of every artisan student who shall submit satisfactory works, executed in the school or class during the then current school year, in drawing or designing for Architecture.

(*See* Art Directory, p. 26, § 3*c*, and p. 36, Stage 23*b*.)

c. Architectural Drawings of the class referred to in the preceding paragraph (§ *b*), executed by students in Science schools or classes are admissible to the advantages of the National Art Competition. (*See* Art Directory, p. 30, § 11.)

The works of students of classes in Subjects II. and III. are not excluded from the advantages of this rule, even if such students should be teachers in other Science subjects.

Free admissions to School of Mines and College of Science.

LXVII. Free admissions to the lectures at the Royal School of Mines, Jermyn Street, or the Royal College of Science, Dublin, are granted to any person who takes a gold medal in the May examination.

Persons who have taken a first or second class in the Advanced Stage in any subject of Science in the examinations of the Science and Art Department, and who show that they are bonâ fide Science teachers, may attend the day lectures gratuitously, provided that they be examined in at least one subject, paying a fee for such examination of *one pound* per course.

Candidates who have obtained a first or second class in the Advanced Stage may obtain tickets of admission to the Educational and Art Libraries at the South Kensington

Museum on application, by letter, addressed to the Secretary of the Science and Art Department.

LXVIII. Science teachers who have taught two years consecutively and passed not less than 30 students each year, are allowed 2nd class railway fare and 3*l.* towards their expenses while living in London—on condition that they remain there five days at least—for the purpose of visiting the South Kensington Museum and other Metropolitan institutions, in order that they may acquire for the benefit of their students a knowledge of the latest progress in those educational subjects which affect the schools. Visits of teachers to London.

Special arrangements with regard to these visits may be made from year to year.

For the year 1871 *arrangements will probably be made to enable a certain number of teachers to stay about six weeks in London to undergo a course of instruction in teaching certain special subjects. Should these arrangements be carried out such teachers will receive* 30*s. a week instead of the above payment.*

Before he proposes to take advantage of the grant the teacher must make application to the Secretary, Science and Art Department: he must also keep a diary (*apply for* Science Form No. 302) during his stay in London, giving the names of the institutions he has visited, with brief observations on them.

Note.—Science Form No. 170 (*see* next page) gives specific instructions as to the dates of returns, &c. *Special attention is called to this and to its concluding paragraph.* All the forms alluded to in this Directory, as well as the *Science Directory* and the *Art Directory* (price 6*d.* each), can be had on application to the Secretary, Science and Art Department, South Kensington, London, W.

Letters addressed thus need not be prepaid in the post.

APPENDIX A.

FORMS and INSTRUCTIONS for GUIDANCE in establishing and maintaining SCIENCE SCHOOLS and CLASSES.

SCIENCE FORM, No. 170.

MEMORANDA FOR THE USE OF SECRETARIES AND MEMBERS OF SCIENCE COMMITTEES.

Dates.	
Constantly - - -	To visit the School and see that the Registers are kept from day to day, and that the regulations of the Department are duly carried out.
When required -	To summon a meeting of the Committee on the occasion of the visit of the Inspector.
1*st November* -	The Report, Science Form No. 120, informing the Department of the existence of a school must be carefully filled in and sent immediately on its opening, or if it be an old school, on its re-assembling after the vacation. This must be accompanied or closely followed by Form No. 88, forming the Committee, or No. 168, continuing a Committee.
	Note.—If the Committee of any School or Class has not been at least provisionally approved by the Department before the 31*st of January in any year, no payments will be made on the results of the examination of that School or Class in the ensuing May.*
Before 28*th Feb.* -	To send Form No. 329, stating in what subjects examination will be required.
Before 31*st March*	To send Form No. 119, giving the precise number of candidates in each subject at the examination in May.
	Note.—No examination will be held where these forms have not been sent in by the dates named.
Before 24*th April* -	To see that Form No. 91 is hung up in the School-room.
On the 27*th April*	If a parcel containing (1) the papers for the candidates to work upon, (2) copies of Form No. 91, one for each day's examination, and (3) envelopes in which to return the worked papers, should not have been received, or if there should be any mistake in the numbers sent for each subject as applied for, or in the covering letter, to communicate *at once* to the Department.
During the May examinations.	The examination papers for each evening will leave London by the night mail two evenings before, *i.e.*, Thursday evening papers will leave on Tuesday evening, Friday's on Wednesday evening, Monday's on Friday evening, etc. Should they not arrive accordingly, a telegram to be sent *at once* to the Department.

On the evening of examination. The candidates, being all seated at 6.50, to read out the rules on Form No. 91, then give out the papers to be worked on. Then at 6.55 to break the seal of the examination papers and distribute to the candidates. To adhere rigidly to the rules on Form No. 91. To sign Form No. 91. To seal up the papers in one of the envelopes provided and at once post them.

If no candidates are examined the envelope of examination papers to be returned unopened, or if two sets of papers have been sent, one set to be returned unopened. To return Form No. 400 before 25th May.

After the May examinations. On receiving printed lists of the results, to give one copy to each candidate whose name appears in it as being successful; to inform the others that they have failed.

To return, as soon as possible, Form No. 161, filled up in strict accordance with the rules on Form No. 110. (Prize List). To call a meeting of the Committee to examine and certify the Teacher's claims for payment, Form No. 51, and the School and Class Registers, which must be sent up at the same time. To return Form No. 108.

To keep a record, and inform the Department, of the number of individuals examined.

NOTE.—*Whenever it becomes necessary to write to a school for a form, or for a return which ought to have been made, and through neglect has not been sent in, a stoppage of five shillings will be made from the next payments on results; and for every day's delay through neglect in sending in the returns noted on this form a stoppage of half-a-crown.*

SCIENCE AND ART FORM, No. 88.

LOCAL COMMITTEES FOR SCHOOLS AND CLASSES RECEIVING AID THROUGH THE SCIENCE AND ART DEPARTMENT.

1. A Local Committee of not less than five well-known responsible persons must be formed in connexion with every school or class, in order to comply with the necessary requirements of the Science and Art Department, and to carry out various arrangements on its behalf necessary for testing the efficiency of the instruction, on the proof of which alone the aid of the Department will be given.

2. The gentlemen who intend to act on this Committee must sign the form on the next page, stating their willingness to carry out the necessary arrangements for examinations, and to observe all the regulations of the Department; each member after signing must also give his address and occupation. Care must be taken that the members who sign the form are properly acquainted with the duties they propose to discharge; a summary of these duties is given below (see § 5), and they are laid down at greater length in the Science and Art Directories, which can be obtained on application to the Secretary of the Department.

3. When a school or class is first formed, the form on the next page must be signed at a general meeting of the Committee. If the same Committee continue to act, it will only be necessary to fill up Form No. 168, which expresses the willingness of the members to undertake their duties for another year: but no one can be a member of a Committee, nor

assist in the conduct of an examination, who has not signed the form on the next page.

The relation of the teacher to the Committee of a school or class will vary much, according to the varying circumstances of different localities. With this and other local arrangements the Science and Art Department does not interfere, but leaves them to the locality to settle.

5. The Science and Art Department requires that the Local Committee hall—

a. Be responsible for the safe custody of all apparatus towards the purchase of which the Department has granted aid.

b. Provide a room or rooms of sufficient size to carry out the annual examination according to the detailed regulations under that head. This examination is of *all* persons who wish to present themselves, and not only of those attending the school or class; but those persons who do not belong to the school or class must send in their names at the appointed time, and may be required to pay a registration fee of 2*s.* 6*d.* for the whole examination.

c. See that the school registers, showing the occupations of the various students, their attendance, number of lessons, payments of fees, &c., on the approved forms (Science Forms Nos. 139 and 139*a*, and Art Forms Nos. 531, 532, 533, and 534), be kept properly filled up, and sent to the Science and Art Department when required.

d. Send, when required, to the Secretary of the Science and Art Department the list of students to be examined, specifying the subjects in which they are to be examined. Be responsible for conducting and superintending the examinations in accordance with the rules of the Department; giving out the examination papers which will be sent for that purpose: seeing them fairly worked and certifying to the same, not less than three of the Committee being always present: and sending the worked papers, under seal, by the day's post to the Secretary of the Science and Art Department.

e. When required, transmit to South Kensington works for examination executed in the school during the previous year, and make an annual report of the proceedings of the school or class.

f. Certify that those students on whose examination claims to payments on results are based, are artisans or operatives, or can claim as such; and that the payments claimed are due according to the regulations.

g. Certify that those students, on account of whose instruction in Science payments are claimed, have received 25 lessons at least from the teacher in the year, or since the last examination, on their passing at which payment was claimed on their account.

6. The school or class must be at all times open to the visit and inspection of the officers of the Science and Art Department as a condition for the grant of aid from it; if at any time it is found that the apparatus, examples, &c., towards the purchase of which a grant has been made are not properly taken care of, or that a proper room with firing, lighting, &c., is not provided for the class, the aid of the Department may be withdrawn.

7. The school or class will be inspected periodically by an officer of the Science and Art Department, who will report whether the regulations be strictly carried out. At his visits, of which due notice will be given, a meeting of the Committee must be held to receive him, when as many of the members as possible are expected to attend.

FORM of APPLICATION to act as a COMMITTEE for a SCHOOL or CLASS receiving AID through the SCIENCE and ART DEPARTMENT.

This Form is to be filled in, signed at a general meeting of the Committee, and returned to the Department immediately on the formation of a school or class.

If the Committee of any school or class has not been at least provisionally approved by the Department before the 1st February in any year, no payments will be made on the results of the examination in the ensuing May of that school or class.

When a Committee continues to act for another year for a school or class, Form No. 168 should be transmitted, and this form be signed by new members only.

We, the undersigned,

[*h.* The Committee must consist of a Chairman, Secretary, and at least three other Members, and must be composed entirely of well-known responsible persons of independent position, who have no such personal interest in the school or class as can lay them open to the slightest suspicion of partiality. Relations and pupils of the teacher, persons wishing to be examined, or who are under instruction in any school or class receiving aid from the Science and Art Department, and teachers of any description having pupils who are candidates for the examinations of the Department, are not eligible as members of the Committee.

NOTE.—A gentleman whose son or daughter attends any examination of the Science and Art Department is thereby disqualified from superintending any of the examinations that year, though he may act on the Committee in other respects.

i. It is very desirable that as many persons as possible in recognised positions of public responsibility in the district, such as Magistrates, Municipal Authorities (Mayor, Aldermen, or Town Councillors), Heads of Educational Establishments (Trustees of Grammar Schools, Managers of National Schools), Clergymen, &c., should be on the Committee. It is *absolutely necessary* that at least two such responsible persons should agree to act.

k. The Chairman must be a Magistrate, Mayor, Boroughreeve, Provost, Alderman, or other public officer of recognised position, Trustee of Grammar School, Clergyman of the Established Church in parochial employment, or minister of religion in charge of a licensed place of public worship. He will have to certify that the constitution of the Committee is in accordance with the above requirements.

l. The Secretary of the Committee of the School or Class, as being the medium of communication, will carry on all correspondence with the Science and Art Department, and is held responsible for making out and sending all returns required, for the receipt and distribution of the examination papers, the transmission of the worked papers, &c., at the proper times according to the regulations.]

propose to act as the Local Committee for the

______________________________ [Science School, Science Class, School of Art, or Art Night Class.]

held at the ______________________________ [Name of Institution or Building.]

______________________________ [Name of Street or Place.]

______________________________ [Name of City, Town, or Village.]

and taught by ______________________________

____

______________________________ [Give the names of all the teachers.]

We undertake for the year ending 31st August 18 at least, and further till another Committee satisfactory to the Science and Art Department has been appointed,

1. To be responsible for the safe custody of all the Apparatus, Diagrams, Examples, Casts, &c., towards the purchase of which the Department has in any way contributed.
2. That three or more of our number will be ready at the appointed time to be present at, and superintend, the examinations of the School or Class according to the instructions of the Science and Art Department, and give the teachers the necessary vouchers.
3. That a room or rooms shall be provided for the due carrying out of such examination, according to the rules of the Department, providing sufficient space for the examination, not only of all persons taught in the School or Class, but of all others who may wish to attend the examination.
4. When required to transmit to South Kensington works for examination, and to make an annual report of the School or Class; and to comply with the regulations of the Science and Art Department.
   (A fee of not more than 2*s.* 6*d.* may be charged on each applicant for examination who is not a student in the class, to reimburse the Committee for any extra expenses they may be put to in providing a room.)
5. That the School or Class shall be open at any time to the visit and inspection of the Officers of the Science and Art Department.

SIGNATURE.	ADDRESS.	Occupation, specially stating how fulfilling the conditions of rules "*h*" and "*i*" above.
NOTE.—*On the formation of a Committee this form should be signed at a general meeting.*		
_____________ *Chairman.*		
_____________ *Secretary.*		

I certify that this Committee complies with the requirements of the rules *h*, *i*, and *k*.

_____________ *Chairman.*

It occasionally happens that there are gentlemen interested in the school whom it would be advantageous to have on the Committee, but who are disqualified according to rules *h*, *i*, *k*, from acting on the Committee in any of the business connected with the examinations. These gentlemen must sign the form below.

We agree to the preceding undertaking with the exception of clause 2.

SIGNATURE.	ADDRESS.	OCCUPATION.

I recommend that the gentlemen named above may be allowed to act on the general committee of management, it being understood that they will have nothing to do with conducting the examination.

_____________ *Chairman.*

The Secretary,
Science and Art Department,
South Kensington, London, W.

SCIENCE AND ART FORM, No. 168.

FORM OF APPLICATION TO RENEW A COMMITTEE.

To be sent in before the 15th November.

SIR,

WE have the honour to inform you that a meeting of the Committee of

the ____________________ [Science School, Science Class, School of Art, or Art Night Class.]

established at the ____________________ [Name of Institution or Building.]

at ____________________ [Name of Town or Village.]

was held at the ____________________ [Place of Meeting.]

on the ________________, at which the following members were present:—

and we were authorised by them and the following members,

who could not attend, to inform you that they are prepared to continue to act

as the Committee of the ____________________ [School or Class.]

for the year ending 31st August 18 .

We have also to inform you that additional members who have joined the Committee have signed the enclosed Form No. 88. [This paragraph to be erased if it does not apply.]

The School will be taught by the following teachers during the session:—

____

____

____

We have the honour to be, SIR,
Your obedient Servants,

____________________ *Chairman.*

____________________ *Secretary.*

To the Secretary,
Science and Art Department,
South Kensington, London, W.

SCIENCE FORM, No. 120.

SCIENCE CLASSES UNDER TEACHERS QUALIFIED TO EARN PAYMENTS.

Annual Report of Science School or Class,

To be made on its establishment, and annually immediately on recommencing after the summer vacation.

In all cases this form must be sent in before the 1st November.

Name of Town ______________________

Place, as Mechanics' Institution, &c., in which the Classes are held ______________________

Name of Street, No., &c. ______________________

Teachers' names.	Their private addresses.

Total No. of individual Students ____________

(If a student attends two or more classes he must only be counted as one student.)

Classes in (state subject in terms of the Science Directory).	Fees.	No. of Students.	Days on which they meet.	Hours of Meeting.	Period of the Year during which the Classes continue.

______________________ *Secretary.*

______________________ *Address of Secretary.*

SCIENCE FORM, No. 51.

Application for Payment from ______________________ [Name of teacher.]

Science Teacher in ______________________ [Name of school or institution.]

at ______________________ [Name of town or village.]

On behalf of the Committee of Management of this School, We do hereby certify that :—

(1.) Mr. ______________________ has duly performed the various duties devolving upon him as a Science Teacher in the School, during the ________ ending ______ day of ______________ 18 .

(2.) He has given the following students at least 25 lessons during the year, or since the last examination at which payment was claimed on their account, in each subject for which payment is claimed.

(3.) The under-mentioned students belong to the industrial classes, as coming within one of the following categories :—

a. Artisans or operatives in the receipt of weekly wages.
b. Coastguards, policemen, and others who, though in the receipt of weekly wages, do not support themselves by manual labour.
c. Teachers of elementary schools in connexion with the Education Department, Whitehall, or the National Board of Education, Ireland.
d. Persons in the receipt of salaries not large enough to render them liable to the income tax, as some descriptions of clerks, shopmen, &c.
e. Small shopkeepers employing no one but members of their own family, and not assessed to the income tax.
f. Tradesmen and manufacturers on their own account, supporting themselves by their own manual labour, not employing apprentices, journeymen, &c., and not assessed to the income tax.
g. The children (not gaining their own livelihood) of all such persons above mentioned.

Examined and certified at a meeting of the Committee held for that purpose at ____________ [Place of meeting.] on the ______ day of ______ 18 .

______________________ *Chairman* or *Secretary*.

____
______________________ } *Two members of Committee.*

I hereby certify that the following particulars are correct.

______________________ *Teacher*.

______________________ [State how qualified to earn payment.]

Names of Passed Students.

N.B.—The names of the students must be arranged alphabetically. After each student's name must be placed, each in a separate line, his several successes (if he has more than one); and in the last column the amount claimed on each success, after making the proper deductions.

Surname.	Christian Name in full.	Age last Birthday.	Trade, or Father's Trade. When father's trade is given put (*f.*) after it.	State under which of the Categories *a. b, c, d, e,* Claim is made.	Position at the late Examination. Subject. *In Roman Numerals.*	Stage.	Class. *In Arabic Numerals.*	Highest Position in same Subject in any previous Examination.	Payment claimed.

[SPECIMEN.]

SCIENCE FORM, No. 51.

Application for Payment from *William Brown,* [Name of teacher.]
Science Teacher in *the Mechanics' Institute,* [Name of school or institution.]
at *Worksop* [Name of town or village.]

On behalf of the Committee of Management of this School, We do hereby certify that:—

(1.) Mr. *William Brown* has duly performed the various duties devolving upon him as a Science Teacher in the School, during the *year* ending *30th* day of *June* 18*70;*

(2.) he has given the following students at least 25 lessons during the year, or since the last examination at which payment was claimed on their account, in each subject for which payment is claimed ;

(3.) the under-mentioned students belong to the industrial classes, as coming within one of the following categories :—

a. Artisans or operatives in the receipt of weekly wages.
b. Coastguards, policemen, and others, who though in the receipt of weekly wages, do not support themselves by manual labour.
c. Teachers of elementary schools in connexion with the Education Department, Whitehall, or the National Board of Education, Ireland.
d. Persons in the receipt of salaries not large enough to render them liable to the income tax, as some descriptions of clerks, shopmen, &c.
e. Small shopkeepers employing no one but members of their own family, and not assessed to the income tax.
f. Tradesmen and manufacturers on their own account, supporting themselves by their own manual labour, not employing apprentices, journeymen, &c., and not assessed to the income tax.
g. The children (not gaining their own livelihood) of all such persons above mentioned.

Examined and certified at a meeting of the Committee held for that purpose at *the Mechanics Institute, Worksop* [Place of meeting.] on the *25th* day of *July* 18*70.*

John Richards, Chairman ~~or Secretary.~~

Alfred H. Dickson
Walter Harrison } Two members of Committee.

I hereby certify that the following particulars are correct.

William Brown, Teacher.

2nd Class Certificate in I., II., III.; 1st Class in X. and XI., 1867; 2nd Class in VIII. and IX., 1868; 2nd Class Honours in IV., 1869. [State how qualified to earn payment.]

NAMES OF PASSED STUDENTS.

N.B.—The names of the students must be arranged alphabetically. After each student's name must be placed, each in a separate line, his several successes (if he has more than one) ; and in the last column the amount claimed on each success, after making the proper deductions.

Surname.	Christian Name in full.	Age last Birthday.	Trade or Father's Trade. When father's trade is given put (*f.*) after it.	State under which of the Categories, *a*, *b*, *c*, *d*, *e*, Claim is made.	Position at the late Examination. Subject. *In Roman Numerals.*	Stage.	Class. *In Arabic Numerals.*	Highest Position in same Subject in any previous Examination.	Payment claimed.
									£
Adams -	*John James.*	*14*	*Tailor (f.)*	*e.*	*X.*	*A.*	*1*	*E.*	*2*
"	"	"	"	"	*XI.*	*E.*	*2*	—	*1*
			Carried over -		- -	- -	- -	- -	£3

Names of Passed Students.

N.B.—The names of the students must be arranged alphabetically. After each student's name must be placed, each in a separate line, his several successes (if he has more than one); and in the last column the amount claimed on each success, after making the proper deductions.

Surname.	Christian Name in full.	Age last Birthday.	Trade, or Father's Trade. When father's trade is given put (f.) after it.	State under which of the Categories a, b, c, d, e, Claim is made.	Position at the late Examination. Subject. In Roman Numerals.	Stage. A. or E.	Class. In Arabic Numerals.	Highest Position in same Subject in any previous Examination.	Payment claimed.
									£ s.
	Brought forward			- -	- -	- -	- -	- -	3 0
Carter -	*William Henry.*	*22*	*Clerk in Gas Works.*	*c.*	*X.*	*E.*	*1*	*E. 3*	*1 10*
Jones -	*Richard*	*23*	*Bricklayer*	*a.*	*I.*	*E.*	*1*	*E. 2*	*1 0*
"	"	"	"	"	*III.*	*A.*	*2*	*E. 2*	*1 0*
Robinson	*Peter Charles.*	*20*	*Fitter* -	*a.*	*I.*	*A.*	*1*	*A. 2*	*1 0*
"	"	"	" -	"	*II.*	*A.*	*2*	*E. 1*	*1 0*
"	"	"	" -	"	*IV.*	*E.*	*2*	—	*1 0*
Smith -	*Robert*	*18*	*Postman (f).*	*b.*	*VIII.*	*A.*	*1*	*E. 2*	*2 0*
"	"	"	"	"	*IX.*	*E.*	*2*	*E. 3*	*0 10*
"	*Arthur H.*	*15*	*Publican (f).*	*d.*	*IV. and V.*	*3*	*1*	*A. 2 in IV.*	*2 0*
Thomson	*Charles*	*16*	*Office-boy*	*b.*	*IV. and V.*	*1*	*1*	*E. 3 in IV.*	*Nil.*
"	*George* -	*19*	*Joiner's App.*	*a.*	*IV. and V.*	*3*	*1*	*A. 1 in IV.*	*1 0*
"	"	"	"	"	*IV. and V.*	*4*	*2*	*E. 3 in V.*	*1 0*
"	"	"	"	"	*IV. and V.*	*6*	*2*	"	*1 0*
Watson	*William*	*18*	*Pupil-teacher.*	*e.*	*IV. and V.*	*3*	*2*	*A. 2 in IV.*	*1 0*
"	"	"	"	"	*IV. and V.*	*5*	*1*	*E. 2 in V.*	*1 0*
"	"	"	"	"	*IV. and V.*	*7*	*2*	"	*1 0*
									20 0

SCIENCE FORM, No. 91.

RULES FOR THE CONDUCT OF SCIENCE EXAMINATIONS.

The following rules must be hung up in the examination rooms or the class rooms for the information of the candidates one week before the examination. They should all be carefully read by the members of the Committee, and those applying to the candidates must be read aloud before the Committee and the candidates **on each night** *immediately before the examination begins.*

Directions to the Committee.

N.B.—The rules are perfectly definite, and in order that the duties of the committee may be as little onerous as possible, it is not left to any one's discretion to modify the rules in the smallest detail.

1. If one room is used, three of the Committee must be present during the whole of the examination, if more than one room then two of the Committee in each room, who must carefully watch the whole examination and see that candidates use no unfair means either by assisting one another or using books or notes. The members of the Committee can, if they wish it, relieve one another, as long as the correct number are always present. *No persons except those under examination, members of the Committee, and officers of the Science and Art Department are permitted to be present in the room during the examination.*

Note.—When there are not more than three candidates it will not be necessary for more than two members of the Committee to be present at the examination.

2. Places must be allotted to the candidates so that they may be seated at least five feet apart, from centre to centre. Ink and pens must be provided. All diagrams, &c., having reference to the subjects of the examination, must be removed from the walls of the examination room. All these arrangements for the accommodation of candidates should be completed by 6.30 p.m.

3. It may be of service to the Committee that the teacher of the class should attend before the examination begins to assist in getting the candidates into their places; his doing so, however, is at the discretion of the Committee. He may see the candidates fill up the forms on the outside of their papers and arrange them in classes for the elementary and the advanced papers, and for honours, which he will explain to the Committee so that there may be no confusion. But *he must leave the room before the examination papers are opened:* information of his having remained in, or returned to the room after this will lead to the examination being cancelled.

Note.—Should the teacher of the class wish to be examined, he must apply specially to the Committee, so that they may arrange to have a table for him close to their own seats, and not with the other candidates.

4. The blank papers supplied by the Department for the candidates to write their answers on should be first distributed, and the Committee should see that the candidates commence by filling in their names, &c., where directed. The arrangement of the candidates and distribution of the papers should be completed before 6.50 p.m.

Note.—Should no candidate present himself for examination, the packet of examination papers must be returned to the Department by the next post *unopened.*

5. At 10 p.m. or, as much sooner as all the candidates have completed their papers, the worked papers must be sealed up in the envelope supplied by the Department for that purpose. Before they are thus sealed up neither the teacher nor any other person, not being a member of the Committee, must be allowed to enter the room.

As soon as they are sealed the packet of papers should (if possible) be immediately posted. If it be impossible to post it the same night it should be placed in the charge of a *member of the committee* and posted the first thing the next morning.

6. On these examinations depend large grants of public money. On their being fairly, honestly, and impartially carried out depends the continuance of the system. The Committees are intrusted with this duty, *but they have no authority to modify the rules in any particular*. They will see, then, how necessary it is to be extremely careful in conducting the examinations, and to insist on the rules being complied with *to the letter*. They are therefore required to fill in and sign the certificate on the third page of this form, and to forward the same with each set of worked papers.

The worked papers of the candidates are, as will be seen from Rule 12, below, to be initialed by members of the Committee. This is to prevent personation. And the Committee will see how essential it is that this duty be not treated as a mere matter of form.

Regulations applying to the Candidates.

To be read to the Candidates on each evening before the Examination Questions are opened.

7. The candidates must be in their places at 6.50 p.m. After this time no candidate should be admitted except under very exceptional circumstances, and by express permission of the Committee, and then *only* if no person has left the room who has seen the examination paper. No candidate may on any account be admitted after 7.30 p.m.

8. The examination papers must be opened in the examination room in the presence of the Committee, at 6.55 p.m. No examination paper may on any pretence be taken from the room before 8 p.m.; *nor after that hour until every candidate has completed and given up his worked paper.*

9. Candidates should not bring anything with them into the examination room,* except pens and pencils. No *blotting paper*, scribbling paper, slates, or anything of the sort that might be passed from one candidate to another, is on any account to be allowed. Rough work and calculations must be done on the supplied form. The back of each leaf of the form, *i.e.*, pages 2, 4, 6, and 8, may be reserved for this purpose, the pen being drawn through to show that they are not for the examiner. *But nothing must be torn off the form.* All books, note-books, &c. must be collected by the Committee.

10. Candidates must not on any pretence whatever speak to one another after the papers have been given out. If a candidate should require to ask a question, he will hold up his hand, when a member of the Committee will attend to him, but no question on the meaning of any portion of the examination paper must be asked or answered.

11. When the examination papers have been given out no candidate may be allowed to return after having once left the room.† On a candidate leaving the room before the examination is over his worked paper and examination questions must be taken up, and he must deliver his paper of questions to the Committee, though he may have them again after his examination is over. At 10 p.m., precisely, all the

* Except such as by the Time Table (Science Form, No. 90) are required.
† It will, therefore, be desirable to make some arrangements for the candidates to retire within the room.

candidates' papers must be collected. It will therefore be advisable to warn them ten minutes before the time. No candidate should on any pretext be allowed to leave the room before 8 o'clock. After that hour, when a candidate has completed his work before 10 p.m., he should be directed by the Committee to leave the room after his worked paper has been taken by a member of the Committee.

12. The papers should be initialed, by the Committee as directed, as they are received from each candidate, as a guarantee that each has been worked by him whose name, &c. it bears. Every paper on which a candidate has written his name, or which bears any marks of his work, must be returned in the sealed packet to the Department.

13. *Should a candidate break any of the foregoing rules, or use unfair means of any description, he must be at once expelled the examination room, and his paper cancelled, the Committee stating on it the cause of his expulsion.*

Certificate by the Committee.

To be filled in and signed by the Committee and forwarded with each set of worked papers.

We, the undersigned members of the Committee of the Science School or Class held at ______________________________
______________________ [name of institution and town.] in ______ [state number of] rooms hereby certify that we were present during the examination ______________________________ [state Subject.] held in the ______________________________ [name of building.] on the evening of the ________________ where the accompanying papers were worked in our presence, and that the foregoing rules have been strictly complied with.

Dated this __________ day of ______________ 18 .

Signatures.	Time Present.	
	Hour of Arrival.	Hour of Departure.

The above rules and directions apply also to the Art Examinations, except when modified by the following:—

Special Regulations applying to the Examinations in Drawing of the Second Grade.

To be read to the candidates before they commence.

(14.) One hour will be allowed for each exercise of the 2nd grade; two papers will therefore be given out in one evening.

(15.) The candidates for the first exercise must be seated in their place at 7.10 p.m. No candidate for this exercise may be admitted, after the papers have been distributed.

(16.) The packet containing the 1st paper must be opened in the examination room, in the presence of the Committee at 7 p.m., and distributed by 7.15 o'clock to the candidates, who must commence by filling up with a black-lead pencil the printed form at the back of the paper. The worked papers must be collected at 8.15 and 9.30 o'clock p.m., and put under cover.

(17.) The papers must be given out in the following order:—

First evening.—First paper, freehand. Second paper, practical geometry.

Second evening.—First paper, model drawing. Second paper, perspective.

(18.) In the freehand and model drawing papers, no ruling, tracing, measuring, or other mechanical means of execution must be allowed or resorted to. When the geometrical, mechanical, or perspective papers are being worked, the candidates must not be allowed to have with them any books or notes, or other paper than that upon which the problems are to be worked. These papers must be given out in the order in which they are packed, so that candidates seated next to each other may not have similar papers. Candidates must be as far removed from each other as the accommodation will allow. All the papers must be worked with the black-lead pencil.

(19.) No candidate can be re-examined in any exercise in which he has previously passed.

(20.) Should any breach of these rules take place the examination may be cancelled, or the payments withheld or reduced.

(21.) The whole number of papers issued must be returned to the Department, whether used or not.

Science Form, No. 402.

LIST OF APPARATUS FOR LABORATORY PURPOSES.

Where a School Laboratory has been established, aid is granted towards the expenses incurred by students in a course of Laboratory Practice according to the regulations laid down in § LXIII., at p. 26 of the Science Directory. The following is a list of apparatus with which each student should be furnished:—

	s.	d.
Conical brass blowpipe with bone mouthpiece - -	2	0
6 inches platinum wire - - - - -	0	6
Platinum foil, 2 inches long, and 1 inch wide - -	1	0
Test tube stand, 24 holes - - - - -	2	0
18 test tubes, 6 in. by ⅝ in. - - - - -	1	9
12 test tubes, 5 in. by ½ in. - - - - -	0	10
2 boiling tubes, 8 in. by 1¼ in. - - - -	0	5
2 Test tube brushes - - - - - -	0	5
Set of 3 beakers - - - - - -	1	0
German flasks, 1 of each, 2 oz., 4 oz., 8 oz., 16 oz., and 30 oz.	1	9
Berlin porcelain crucible 1½ inch diameter - - -	0	4
Berlin porcelain evaporating basins, one of each, 2¾ in. and 3½ in. diameter - - - - - - -	0	11

	s.	d.
Funnels, one of each, 1½ in., 2 in., and 3 in. - - - -	0	6½
English filter paper, cut, two packets of 100 filters each 2¾ in. and 4½ in diameter - - - - - -	0	9½
Iron retort stand with two rings, clamp, and square iron block	7	0
Iron wire gauze, 5 inches square, 2 pieces - - -	0	4
Tin plate sand bath 5 inches diameter - - -	0	4
6 watch glasses, 2 inches diameter - - - -	0	6
½ lb. soft glass tubes $\frac{3}{16}$ to ¼ in. diameter - - -	0	8
½ lb. combustion tube ⅜ in. bore - - - -	0	8
¼ lb. glass rod $\frac{3}{16}$ in. diameter - - - -	0	4
2 feet black caoutchouc tube ⅜ in. bore - - -	1	4
2 feet black caoutchouc tube ⅛ in. bore - - -	0	8
Thistle funnel, 18 inches long - - - - -	0	4
3 dozen assorted corks - - - - -	1	4
Woulf's bottle, 2 necks, pint size - - - -	1	3
Stoppered German glass retort, 2 oz.- - - -	0	7
Set of three cork-borers, $\frac{3}{16}$, ¼, and ⅜ in. with iron rod -	1	0
Triangular file and handle - - - - -	0	8
5 inch round file and handle - - - - -	0	9
Bunsen's gas burner, with blowpipe jet, star support, chimney, and rose burner - - - - - -	3	6
Iron crucible tongs - - - - - -	1	0
4 inch porcelain mortar - - - - -	1	0
Box of test papers, blue and red litmus - - -	0	6
Solution of Cobaltous nitrate ½ oz. stoppered bottle - -	0	7
„ Argentic „ ½ oz. „ - -	0	6
„ Platinic chloride ¼ oz. - - - -	1	9
1 pint methylated alcohol in bottle - - - -	1	6
Glass spirit lamp, 4 oz. capacity - - - -	0	9
Deal box to contain the set of apparatus - - -	2	0
£2	5	1

The set complete can be obtained in a box for 2*l.* from Messrs. J. J. Griffin & Son, Garrick Street, London, W.C.; or Messrs. Jackson and Townson, 89, Bishopsgate Street Within, London, E.C.; but schools are not required to purchase the apparatus at these manufacturers.

NOTE.—The above set of apparatus may be used by two pupils making the same experiments conjointly, but this is not recommended.

FORM No. 694.

SUMMARY of the LAW relating (I.) to the ESTABLISHMENT and MAINTENANCE of PUBLIC LIBRARIES, MUSEUMS, and SCHOOLS of SCIENCE and ART, and (II.) to the ACQUISITION of SITES for such INSTITUTIONS.

N.B.—This summary has been prepared for the **general information only** *of persons desiring to establish Museums and Science and Art Schools, but it must be clearly understood that the Department does not hold itself responsible for its legal accuracy, and the promoters of such institutions are recommended not to take any definite proceedings under the Acts without availing themselves of professional advice.*

I.

1. Any town, parish, district, or union of parishes, is empowered by Act of Parliament (the Act for England is the 18 and 19 Vict. c. 70, Public Libraries Act, 1855; amended by the 29 and 30 Vict. c. 114. *As regards Scotland and Ireland, see* §§ 10 and 11 *below*), to levy a rate not exceeding one penny in the pound for the establishment and maintenance of buildings, with the requisite appliances, suitable for "Public "Libraries and Museums, or both, or for Schools for Science or Art," provided that a majority of more than one-half of the ratepayers present at a public meeting, duly convened, vote in favour of adopting the provisions of the Act.

2. The preliminary steps to be taken with a view to the adoption of the Act are these :—

(*a.*) In *Municipal Boroughs* the Act requires that the mayor shall convene a public meeting on the request of the town council, or on the request in writing of any ten resident ratepayers;

(*b.*) In *Districts* within the limits of any Improvement Act, the district board is to convene a meeting upon the requisition in writing of at least ten resident ratepayers; and

(*c.*) In *Parishes*, the overseers of the poor, on the written requisition of ten resident ratepayers, are to convene a meeting to determine whether the Act shall be adopted.

3. In each case it is necessary that ten clear days' notice of the time, place, and object of the meeting be given by affixing the same on or near the door of every church and chapel, and at least seven days' notice by advertisement in a newspaper published or circulating in the borough, district, or parish, as the case may be.

4. Any expenses incurred in connexion with the meeting, whether the Act be adopted or not, are chargeable upon the borough fund or rates, and may be defrayed, if necessary, by a separate rate specially levied for the purpose, such rate not to exceed one penny in the pound.

5. If any meeting duly convened to determine as to the adoption of the Act decides against it, no meeting for a similar purpose can be held until the expiration of at least a year from the time of holding the previous meeting.

6. If the Act be adopted the organisation for carrying its provisions into operation is as follows :—

(*a.*) In *Boroughs*. "The management, regulation, and control of "libraries and museums, schools for Science and Art, shall be "vested in and exercised by the council," or by such committee

as the council may appoint, and the members of the committee are not required to be members of the council.

(*b.*) In *Districts.* The board or trustees acting in the execution of the Improvement Act, or a committee appointed by them.

(*c.*) In *Parishes.* Not less than three nor more than nine commissioners to be appointed by the vestry, are constituted a body corporate for the purposes of the Act, under the name of "The "Commissioners for Public Libraries and Museums for the Parish "of —— in the County of ——."

7. The council, board, or commissioners are empowered to borrow money at interest, on the security of a mortgage or bond of the borough funds, or of the rate levied under the Act; and the provisions of the Companies Clauses, and Lands Clauses Consolidation Acts, 1845, are incorporated with the Public Libraries Act.

8. Where two or more neighbouring parishes combine for the purposes of the Act, each parish is to appoint not more than three commissioners, and the commissioners for the several parishes are to form one body corporate, and to act together in the execution of the Act. The expenses of carrying the Act into operation are to be borne by the parishes in such proportions as they may mutually approve.

9. It is important to observe that where a public museum or library, or School of Science or Art, has been already established under any Act relating to public libraries or museums, a similar institution, may be established in connexion therewith without any further proceedings being taken under the Act.

10. The following are the general Acts of Parliament relating to the establishment and maintenance of public libraries, museums and Schools of Science or Art. Those printed in italics have been superseded by the others:—

Stats. *8 and 9 Vict. c.* 43; *13 and 14 Vict. c.* 65; *16 and 17 Vict. c.* 101; *17 and 18 Vict. c.* 64; *17 and 18 Vict. c.* 103; 18 and 19 Vict. c. 40 (Public Libraries Act, Ireland, 1855); 18 and 19 Vict. c. 70 (Public Libraries Act, 1855); 29 and 30 Vict. c. 114 (Public Libraries Amendment Act, England and Scotland, 1866), repealed so far as it relates to Scotland by the 30 and 31 Vict. c. 37 (Public Libraries Act, Scotland, 1867).

11. The provisions relating to the establishment and maintenance of libraries and museums, &c. in Scotland and Ireland are substantially the same as the provisions of the Act for England, but there are some differences in matters of detail, for which it will be advisable to refer to the Acts themselves, namely, for Scotland, Stat. 30 and 31 Vict. c. 37, and for Ireland, Stat. 18 and 19 Vict. c. 40.

II.

12. By 17 and 18 Vict. c. 112 (intituled "The Literary and Scientific "Institutions Act")—after reciting the expediency of affording greater facilities for obtaining and settling sites and buildings in trust for institutions established for the promotion of literature, science or art, or for the diffusion of useful knowledge; it is provided that such persons and corporations, as are described in the 4 and 5 Vict. c. 38,* may

* These are, (1) any person being seised legally or equitably in fee simple, fee tail, or for life, in any manors or lands of freehold, copyhold, or customary tenure, and having the beneficial interest therein, in possession for the time being; and (2) any corporation, ecclesiastical or lay, sole or aggregate, in whom land may be, in any manner, vested,—subject to the proviso that no ecclesiastical corporation sole below the dignity of a bishop may make such grant without the consent in writing of the bishop of the diocese.

grant, convey, or enfranchise, either by gift, sale, or exchange, in fee simple, or for a term of years, any quantity, not exceeding one acre of their land, for each separate institution, as a site for such institution.

13. These powers are subject to provisos that they shall not be exercised by tenants for life unless the person or persons next in remainder join in the grant; that in case of gratuitous conveyance of waste or commonable land by any lord of a manor, the rights of all commoners and others having interest shall be barred; and that upon any land so granted by way of gift ceasing to be used for the purposes of the institution, it shall revert to the estate out of which it was granted, except only that when the institution is removed to another site, the land may be exchanged or sold for the benefit of the institution. The same Act, of 17 and 18 Vict. c. 112, contains numerous provisions relating to the persons by and to whom, and the manner in which, conveyances may be made; the form of such conveyances; the subsequent sale or exchange of the land; the liability of trustees to whom land is conveyed in trust; the ownership of any personal property belonging to the institution; the power to make byelaws; and the manner in which the institution may afterwards extend or abridge the purposes for which it was established, or may effect its own dissolution or the adjustment of its affairs.

14. The Act applies to every institution, for the time being, established for the promotion of science, literature, the fine arts, for adult instruction, and for the diffusion of useful knowledge. It also applies to the foundation and maintenance of libraries or reading rooms for general use among the members or open to the public, of public museums and galleries of paintings and other works of art, collections of natural history, mechanical and philosophical inventions, instruments, or designs.

15. The conveyance of sites to trustees, or others associated together for educational purposes, has been still further facilitated by recent legislation. It is no longer necessary to acknowledge any deed in order that it may be enrolled in the Court of Chancery (Act 31 and 32 Vict. c. 44. s. 3). If the grantor be a corporation, or if the conveyance be really and bonâ fide made for a full and valuable consideration, enrolment is no longer *compulsory*, although it is still permitted; but in all cases of voluntary grants by individuals, the deed must still, in conformity with the Mortmain Acts (9 George II. c. 36, 9 George IV. c. 85), be enrolled within six calendar months from the date of its execution (31 and 32 Vict. c. 44. s. 2).

SCIENCE FORM, No. 349.

REGULATIONS UNDER WHICH BUILDING GRANTS TO SCHOOLS OF SCIENCE ARE MADE.

1. A grant in aid of a new building suitable for a School of Science, or for the adaptation of an existing building, will be made provided that the school be built—

a. Under the Public Libraries Act (13 & 14 Vict. c. 65., 18 & 19 Vict. c. 70., 29 & 30 Vict. c. 114.), or,

b. In connexion with a School of Art aided by a Department building grant; and subject to the conditions herein-after set forth.

2. All applications for grants out of the parliamentary vote for any year must be sent in on or before the 15th day of November in the year preceding.

3. No grant will be made unless their Lordships are satisfied that,—
   a. There is a population in the neighbourhood which requires a School of Science.
   b. The school is likely to be maintained in efficiency.

4. No grant will exceed *2s. 6d.* per square foot of internal area, and no grant will exceed *500l.*

5. The site, plans, estimates, specifications, title and trust deed, must be satisfactory to the Lords of the Committee of Council on Education.

6. A plan of the site must be forwarded drawn to a scale of one-eighth of an inch to a foot, and showing the boundaries, approaches, and abuttals.

7. The site must be—
   a. In a situation not unhealthy or noisy.
   b. Within convenient distance of the homes of the students.
   c. If possible freehold in tenure, without incumbrance of rights reserved over the surface, or reservation of minerals.*

8. The size and number of rooms will depend on local circumstances and the different sciences to be taught in the school. The plans and sections must be submitted with the application for the grant, and the proposed buildings must be in accordance with the regulations then in force as to size and distribution of rooms, ventilation, and substantial construction.

9. In cases where they may think it necessary, their Lordships will send an officer of the Department to inspect and report on the suitability of the building and site for the purposes of a School of Science.

10. The plans, specifications, and estimates when approved and sealed may be returned to the promoters for use, but must be lodged in the Science and Art Department.

11. A trust deed must be prepared providing—
   a. That the building be used † as "a school for the instruction of "children and adults in the pure and natural sciences appli- "cable to industry and manufactures."
   b. That it shall be open at all times to the inspection of the officers of the Science and Art Department.
   c. That the students shall be instructed by teachers qualified to earn payments on the result of their teaching.
   d. For the constitution of a body of responsible trustees and a committee of management.

12. This trust deed must not be executed until it has been approved in draft by the Lords of the Committee of Council on Education.

13. When the trust deed has been executed, and if necessary enrolled, a copy of it, including all signatures, attestations, and endorsements, must be made on plain unstamped paper, and lodged in the Science and Art Department.

14. The grant is made on presentation of a certificate (with balance sheet annexed) by the building committee of the school, setting forth that the building and conveyance are duly completed, and that the money in hand will, when added to the grant, meet all claims and finally close the account.

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* A leasehold site is not accepted by their Lordships when a freehold site can be obtained.

† If any power of sale, or of appropriating the premises to other uses than those of a school of Science be reserved, the deed must contain a condition securing the repayment of the grant to the Lords of Her Majesty's Treasury.

APPENDIX B.

Syllabus of the Subjects in which Examinations in Science are held by the Department of Science and Art.

SYLLABUS OF THE SCIENCE SUBJECTS.

The following Syllabus has been prepared in order to afford candidates some guide to their reading; but it must be understood that the questions in the examination need not necessarily be on the specific points enumerated.

The examination is by paper, but oral examination may be resorted to. The examination in each subject is distinct. Mention is made of text-books solely to afford a candidate some assistance in selection, and a general idea of the scope of the examination, *and not at all to confine his reading to those works, or to assert that they are the best on the subjects they treat of.*

NOTE.—The "Art" examinations, in practical geometry of the 2nd grade, and in perspective, are held on the same evening as the "Science" examination in Subject I. The papers in practical plane geometry will be of the same character as they have been hitherto. The candidate should therefore be prepared—

(1.) To construct from sufficient data any triangles, parallelograms, polygons, circles, or ellipses required.
(2.) To place these figures in combination with one another.
(3.) To divide lines in given proportions.
(4.) To construct figures similar and proportional to given figures.
(5.) To reduce polygons to triangles of equal area, and vice versâ.

The examination is based on Burchett's Practical Geometry.

This course may therefore be looked upon as a preliminary to Subject I.

In the Art examination in perspective of the 2nd grade, candidates will be required to put into perspective simple solids, or combinations of them, on a horizontal plane, or to ascertain the dimension of such solids from given perspective representations.

No problems will be proposed which cannot be solved by means of vanishing and measuring points on the horizontal line, either with or without the construction of a plan.

Burchett's Practical Perspective and Jewett's Perspective are recommended for study.

Malton's Brook Taylor's Perspective carries the subject further.

SUBJECT I.—PRACTICAL PLANE AND SOLID GEOMETRY.

Every one employed in any constructive art must acquire the power of representing on paper the forms and proportions of the work to be executed, whether it be of machinery, or of civil or naval architecture; and others, not immediately interested in construction require, in surveying, navigation, &c. a knowledge of practical as well as theoretical geometry of a more than elementary order.

Since it is essential to their utility that geometrical drawings should be accurate, the draughtsman must by practice and instruction be sufficiently skilful in the use of his instruments and materials to ensure neatness as well as precision of execution: without these qualifications it is assumed that no one will present himself for examination in this subject.

But although prepared to this extent, the subject may be new to many, especially to those not acquainted with the application of arithmetic and algebra to geometry; it may therefore be necessary to apprise candidates, not only of what kind of knowledge will be expected, but of the form in which the examination papers will be drawn up.

Each paper will contain questions in both plane and solid geometry, about 12 in number, of which the candidate may select any number not exceeding eight, but to obtain a class in either course, a large proportion of the questions answered must be from the solid geometry.

The candidate must also understand that he must strictly comply with the conditions of each question, and not imagine that by substituting

others, provided they are analogous, he may obtain credit for his answer; strict impartiality would be violated by any such latitude. He should also be most careful in attending to the instructions issued to him with the examination questions.

In neither stage must the student expect all the examination questions to be in the very words of the syllabus. He must rather look forward to having problems placed before him, the solution of which depends upon his intimate knowledge of the classes of problem outlined below.

First Stage or Elementary Course.

Plane Geometry.

1. Exercises in neatness and accuracy not requiring any advanced knowledge of geometry, *e.g.*, the construction of an irregular polygon when the length of its sides and magnitude of its angles are given, &c. :—
2. The construction of plain scales.
3. Problems where straight lines only are concerned.
   - *a.* To draw a straight line perpendicular to a given straight line, through a given point, the latter being either within or without the given line.
   - *b.* To divide a line so that the segments may have a given ratio.
   - *c.* To find a mean proportional or a third proportional to two straight lines.
4. To construct a regular polygon of *n* sides upon a given base.
5. To reduce a polygon of *n* sides to an equivalent triangle.
6. To draw circles to touch given lines or circles, or more generally, to work problems where the straight line and circle are involved in various combinations.

Solid Geometry.

A general knowledge of the principles of Projection, and of the meanings of those terms which are in constant use, such as Plan, Elevation, Section, Trace, &c.

Application of those principles, and illustration of the terms in the case of a simple solid resting on the horizontal plane.

Generally :—The elements of descriptive geometry carried so far as to enable the student to represent a solid by its plan and elevation :—

a. When the inclination of one of the planes of that solid is given, and also that of some line connected with the solid and lying in that plane.

b. When the inclinations of two lines connected with the solid are given.

Second Stage or Advanced Course.

Plane Geometry.

1. The division of finite lines, or those lines produced under any of the conditions stated in the previous course, or under those of a more comprehensive character, such as harmonically, &c.

2. To determine by construction *lines* which shall be equivalent to magnitudes given by algebraical expressions, such as—

   a. $\sqrt{m}$, $\sqrt{\frac{m}{n}}$, $\sqrt{\frac{1}{m}}$; (m and n being *numbers.*)

   b. $\overline{a^2 \pm b^2}$, $\sqrt{ab}$, $\frac{\sqrt{ab}}{c}$, $\frac{\sqrt{m} \pm n}{k}$, &c., &c.

3. The construction of polygons from adequate conditions of sides, angles, area, or perimeter.
4. The division of polygons into m areas by parallel lines, or by lines drawn through a given point.
5. To draw circles to touch given lines and circles and to pass through two given points.
6. The construction of those plane curves which are required in practical arts (ellipse, parabola, cycloid, spirals, &c., &c.)
7. The construction of "scales" to drawings, to different units of measure, English and foreign, both plain and diagonal.

Solid Geometry.

a. A more searching examination in the principles and elementary problems of descriptive geometry.

b. Representation of a solid by its plan and elevation when,—
   1. A plane connected with the solid is given, and a line lying in that plane.
   2. Two lines connected with the solid are given.
   3. Two planes do. do.
   4. The height of three points of the solid are given.

c. Problems on the sphere, cone, and cylinder,—
   1. Representation of those solids in given positions and in contact.
   2. The determination of planes tangential to them.
   3. The determination of their sections by planes under given conditions.
   4. The intersection of their surfaces when variously combined, or "penetration."

d. The determination of the shadows of solid bodies bounded either by plane or curved surfaces, as cast by either parallel or converging rays of light.

e. Isometrical projection.

Examination for Honours.

Plane Geometry.

Candidates for honours will be required to make constructions relating to the contact of lines and circles with each other, and with other curves, requiring more knowledge of geometry and the power of making

deductions, than is expected of other candidates; but the questions on these and other subjects will be of a practical utility in geometrical drawing. They must possess some knowledge of analytical geometry, so as to be able to construct lines or circles given by algebraical expressions referring to co-ordinate geometry of two dimensions, such as $\frac{x}{a}+\frac{y}{b}=1$; $x \sin A + y \cos A - p = 0$; $(x-a)^2+(y-b)^2=r^2$, &c., &c.

They should also possess a sound knowledge of the properties of the conic sections, and of those other curves which admit of practical application, such as the epicycloid, evolute, &c.

Solid Geometry.

Problems will be given both in orthographic and radial (or perspective) projection. Amongst other subjects in the former of these must be studied that branch known as isometric projection, the solution of the cases of the spherical triangle by construction, the development of surfaces, and the intersection of curved surfaces. In the radial projection the student must show that he is acquainted with the geometrical principles of that method, and not merely be capable of "*putting into perspective*" a given solid.

Appendix to Syllabus of Subject I.

The following brief outline of an elementary course of descriptive geometry is recommended to the attention of students, especially those who depend a good deal upon their own private study, and are consequently uncertain as to what particular points their chief attention should be devoted to.

1. The representation (by its plan and elevation) of a point in space in all the combinations of position of which it is capable (*i.e.*, whether above or below the horizontal plane, before or behind the vertical plane).
2. Having given the plan and elevation of a line, with its extremities situated in given positions with regard to the co-ordinate planes to determine:—

   1°. Its "traces."

   2°. Its true length, and its inclination to each plane of projection.

   Deduction.—To draw the plan and elevation of a line of given length when inclined at $a°$ to the horizontal, $b°$ to the vertical plane.
3. Having given the "traces" of a plane in any position or direction with regard to the "ground line" to determine the inclination of that plane to each plane of projection, and also the real angle contained by those traces.

   Note.—In all cases where traces of a plane are concerned, the student will find his comprehension greatly assisted by the aid of a paper diagram or model, thus:—If he draws a ground line on a piece of paper, and the two traces of a plane meeting at some point on that line, and then folds the paper at the ground line, so that the one portion is at right angles to the other (thereby representing the co-ordinate planes), he will then very readily see how those two traces determine the position of a plane, and will see more clearly the reason for drawing the various lines necessary to solve the problems on planes given above.

   The "deduction" from the above problem, namely, to draw a plane that shall make given angles with the planes of projection, had better not be attempted yet by the beginner.

4. To place in a given plane a line, indefinite or otherwise, having a proposed inclination.

The student should be fully aware of the great advantages obtained by assuming the vertical plane of projection at right angles to the given plane, or, as it appears on paper, by taking the ground line at right angles to the horizontal trace.

5. To draw the plan and elevation of a line at right angles to a given plane.

1°. From a point in the plane to be of given length.

2°. From a point outside the plane.

6. Reverting to problem 4:—Draw the plan, &c. of a line a'' long inclined at A°, but lying in a plane inclined at B°, and complete the plan of the square, of which this is one side.

It is scarcely necessary to warn the student against assuming the A° larger than the B°.

In this construction will be introduced the all-important process of "*constructing*" the plane, *i.e.*, turning it round upon its horizontal trace, as hinge, till it takes up itself a horizontal position, and the points, lines, &c., lying in it, are seen in their true relative positions.

The porblem (6) may be infinitely varied as the given "line a'' " long," need not necessarily be a *side* of the plane figure whose plan is to be determined, but any line connected with it.

7. Let the square in the last problem be one of the faces of a cube. With the aid of problem 5 complete the plan of the cube.

The student will have thus arrived at the first case of solids represented under given conditions, the data in this case being the inclination of *a plane*, and the inclination of *a line* lying in that plane. But he must not neglect in his course the study of the simple geometrical solids, when resting on the horizontal plane with one face or the base in contact with it. The cube, tetrahedron, and octohedron, as also the pyramid and prism, should be studied in these positions and sections, or sectional elevations should be determined as formed by planes given in various positions.

8. To find the angle contained by two straight lines which meet (*i.e.*, the projections of the lines being given).

9. To find the angle formed by a given straight line and a plane.

10. To find the angle formed by two intersecting planes.

Deduction. Through a given straight line, lying in a given plane, to draw a second plane, which shall form an angle of A° with the first.

11. Two lines of given length contain an angle of A°. The one is inclined at B°, the other at C°. Draw the plan of the lines in that position, and determine the inclination of the plane containing them.

Memo.—A°, B°, and C° together must not exceed 180°.

12. Two lines, each a'' in length, bisect one another, and are at right angles. The one is inclined at A°, the other at B°. Considering these to be two diagonals of an octohedron, complete the plan of the solid.

The student here arrives at the second important case of solids from conditions, the data in this case being the inclinations of *two lines* connected with the solid.

This brief course only professes to point out to the student those problems which call for his earliest and most careful attention, either as involving an important principle, or as being the key to other branches of the subject. He will find that after mastering these, that other problems that he may meet with in his examination papers or text-books will have lost much of their apparent difficulty.

Problems with reference to curved surfaces cannot be introduced into a brief syllabus like this, as they cannot well be studied without the aid of an experienced teacher, and, as regards this last remark, the student is recommended constantly to bear in mind that 10 minutes verbal instruction in this subject is worth nearly one hour's private study of a text-book.

Text Books.

For Theoretical Geometry.

Any of the numerous editions of Euclid's Elements, such as,—

Euclid's Elements of Geometry (School Edition), by R. Potts, 12mo., 4*s*. 6*d*. (London, Longman, 1868.)

Geometry, Plane, Solid, and Spherical (Library of Useful Knowledge). (Baldwin, 1830.)

For Analytical Geometry:

Treatise on Plane Co-ordinate Geometry as applied to the Straight Line and the Conic Sections, by I. Todhunter, 8vo., 7*s*. 6*d*. (London, Macmillan, 4th ed., 1867.)

A Treatise on Conic Sections, by G. Salmon, 8vo., 12*s*. (London, Longman, 4th ed., 1863.)

Treatise on the Analytical Geometry of Three Dimensions, by J. Hymers, 8vo., 10*s*. 6*d*. (Cambridge, Deighton, 3rd ed.)

A Treatise on Algebraical Geometry, by W. Waud (Library of Useful Knowledge). (Baldwin, 1835.)

For Practical Geometry.

Practical Geometry, by Thos. Tate (Gleig's series), 18mo., 1*s*. (London, Longman, 1868.)

Elements of Geometrical Drawing, by Thos. Bradley, in two parts, oblong folio, each 16*s*. (London, Chapman & Hall, 1862.)

Elements of Descriptive Geometry, by J. Woolley, text 8vo., plates 4to., 20*s*. (London, Parker, 1850.)

Elementary Geometrical Drawing, by S. H. Winter, in two 8vo. parts, 3*s*. 6*d*. and 6*s*. 6*d*. (London, Longman, 1861.)

Elementary Treatise on Descriptive Geometry, by J. F. Heather (Weale's series), 12mo., 2*s*. (London, Weale, 1851.)

First Lines in Geometrical Drawing, by J. F. H. De Rheims, 8vo., 9*s*. (London, Williams & Norgate, 1865.)

Hall's Descriptive Geometry. (John Parker, West Strand.)

Practical Geometry, by R. Burchett. (London, Chapman & Hall, 1859.) (For Plane Geometry only.)

The following are most valuable as works of reference on the subject of Descriptive Geometry, but, with the exception of the third, are too diffuse and comprehensive to be used as text-books by the generality of students :—

Traité de Géométrie Descriptive, par J. Adhémar (with Atlas), 8vo. 20*s*. (Paris, 4th ed.)

Essais de Géométrie sur les Plans et les Surfaces Courbes, par S. F. Lacroix. (Paris, 7th ed.)

Traité de Géométrie Descriptive, par Lefébvre de Fourcy, 2 vols., 8vo. (Paris, 1864.)

Traité de Géométrie Descriptive, par La Vallée (with Atlas), 4to., 15*s.* (Paris, 2nd ed., 1825.)

Traité de Stéréotomie, &c., par C. F. A. Leroy, *annotée* par E. Martelet, 4to. (with Atlas in folio). (Paris, 1866.)

Notes et Croquis de Géométrie Descriptive, par Bardin, folio, 10*s.* (Paris, 2nd ed., 1837.)

SUBJECT II. MACHINE CONSTRUCTION AND DRAWING.

It is assumed that the candidate has already acquired the power of representing objects in orthographic projection, and of drawing to scale (*see* Subject I.), and that he is capable of drawing well and neatly; the examination in this subject then will, besides this, test his knowledge of the form and construction of the elementary parts of machines. Small sketches of machine details will be given, more or less incomplete, with the principal dimensions. The candidate will be required to make from these complete drawings to a given scale. Generally more than one view of each detail will be required, and the several views must be properly projected from each other. The candidate should first set out the centre lines of the drawing and should set off the dimensions from them. The candidate should indicate by diagonal shading the parts cut by planes of section. Any indication that the candidate has merely copied the sketches given, without understanding the principle of the mechanism, will invalidate his examination.

First Stage or Elementary Course.

The candidate will only be required to show an acquaintance with the simplest elements of machines, and the simplest methods of combining parts of machines.

Second Stage or Advanced Course.

The candidate must show a wider and more accurate knowledge than is required for the elementary course, and a power of drawing more complex combinations. He may be required to draw one view of a part of a machine from details given in other views. For instance, a plan from given elevations.

The following list is not intended to be exhaustive, but it indicates the more important parts of machines, with the form and construction of which candidates for the elementary and advanced courses should be familiarised.

Proportions of bolts and nuts; connexion of cast-iron parts by bolts and flanges; connexion of parts by a key; connexion of parts by a cotter, or by gibs and cotter.

Shafting with collars, and bosses. The simpler forms of couplings for shafts. Half lap coupling; box coupling; face plate coupling.

Forms of wrought and cast iron crossheads. Of engine connecting rods. Of cast and wrought iron cranks. Of eccentrics.

Pedestals and plummer blocks. Forms and proportions of steps. Brackets for carrying shafts.

Spur wheels, bevel wheels, mortice wheels. Pullies for belting. Fast and loose pulley; cone pullies.

Construction of steam-engine piston, and of air-pump bucket.

Form and construction of various kinds of valves. Ball valve; conical or puppet valve; flap valve; Indian-rubber disc and butterfly valve; double-beat valve, sliding valve, or sluice.

Glands and stuffing boxes.

Pipes and pipe joints.

Arrangement of simple steam cylinder and valve chest, with steam passages.

Arrangement of simple form of air pump and valves.

Arrangement of simple form of force pump and valves.

Examination for Honours.

The candidate will have to pass an examination designed to test his knowledge of the principles and practice of machine construction, his answers being illustrated, when necessary, by careful hand sketches. He may be examined as to the general construction and principles involved in the action of the most important varieties of steam engines, water-wheels, pumps, presses, and machine tools. He should be acquainted with the forms and most obvious proportions of transmissive machinery, shafting, gearing, &c., and the modes of varying velocity in machines. He should know how, in the simpler cases, to proportion a part of a machine to the load it has to carry. He should have some knowledge of the material of which different parts of machines should be constructed.

In addition the candidate will have to design some portion of an engine or machine from a general description, and to prescribed dimensions. He must show a practical acquaintance with the construction of the machine, and a power of proportioning its parts. He should aim at producing a working drawing. This design the candidate will have to execute at his own home in a specified time.

Text Books and Books of Reference.

Rudimentary Principles of the Construction and Working of Machinery, by C. D. Abel, C.E. (Virtue and Co.)

Practical Treatise on Mill Gearing, by Thomas Box. (E. and F. N. Spon.)

Catechism of the Steam Engine, by John Bourne. (Longmans.)

Machinery and Millwork, by Professor J. M. Rankine. (Griffin.)

Treatise on Mills and Millwork, by Sir W. Fairbairn, C.E. (Longmans.)

The Elements of Mechanism, by T. M. Goodeve. (Longmans.)

Der Constructeur von F. Reuleaux. (F. Vieweg und Sohn Braunschweig.)

Le Vignole des Méchaniciens. Essai sur la Construction des Machines. Armengaud. (A. Morel et Cie., Paris.)

SUBJECT III. BUILDING CONSTRUCTION.

As the object of this Course of Instruction is to lay the foundation of a sound knowledge of the principles, as well as of the practice, of Building Construction, and so lead the workman to labour with his head at the same time as with his hands, the teacher should not, necessarily, attempt to push the students through the whole of the subjects enumerated in this syllabus, but should limit the range of his tuition according to the time at his command and the intelligence of the pupils.

A larger number of questions will be set in the examination papers for the Elementary and Advanced Stages, than the candidates will be allowed to attempt, so that he will, to a certain extent, be able to show his knowledge in such branches as he may, from circumstances, have paid special attention to. For instance, a student better acquainted with iron than wooden structures will be able to select a question on iron, in preference to one on wood, work. In order, however, to ensure that special attention shall not be given to work of one description *only*, a certain number of the questions given, about one half, will be compulsory, *i.e.*, the candidate must attempt these, and unless he shows a sound knowledge of work of more than one kind, by answering a fair proportion of them, the rest of his paper will not be considered.

Moderately good drawing, showing an intelligent knowledge of the subject, will always be awarded higher credits at the examination than more highly finished drawings, exhibiting an ignorance of constructive details.

First Stage, or Elementary Course.

It is assumed that the student has already mastered the use of the following drawing instruments:—rulers, ordinary and parallel; ruling pen; compasses, with pen and pencil bow-sweeps, as well as the construction and use of simple scales, such as 1, 2, 3, or more feet to the inch, showing inches; or such as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{3}{8}$, $\frac{5}{8}$, or other fraction of full size, or of any given scale or drawing: and the meaning of such terms as Plan, Elevation (front, back, or side), Section, Sectional Elevation.

He should understand the object of bond in brickwork, *i.e.*, English bond, Flemish bond, or English bond with Flemish facing, and how it is attained in walls up to three bricks thick, in the following instances, viz., footings with offsets, angles of buildings, connexion of external and internal walls, window and door openings with reveals and square jambs, external gauged arches (camber, segmental, and semi-circular), internal discharging arches over lintels, and inverted arches.

He should know where to put wood bricks, or plugging, and their use; the construction and uses of brick corbeling, and the construction of trimmer arches in fire-places.

He should be able to give sections and elevations to scale of the following kinds of mason's work, viz., uncoursed and coursed rubble, block in course, and ashlar, with their bond, and the proper dimensions of the stones, as to height, width of beds, and length; and of the following dressings, viz., window sills, window and door jambs, plain window and door heads, door steps, string courses, quoins, copings, common cornices, blocking courses; and of the following methods of connecting stones, viz., by cramps, dowels, joggles, and lead plugs.

He should be able to show how to join timbers by halving, lapping, notching, cogging, scarfing, fishing, and mortise and tenon; as applied to wall plates, roof timbers, floors, ceilings, and partitions.

He should be able to draw, from given dimensions, couple, collar, and kingpost roofs, showing the details of the framing and of the ironwork.

He should be able to draw, from given dimensions, single, double, and framed floors, with or without ceilings beneath them; showing modes of supporting, stiffening, and framing the timbers, trimming round hearths and wells of stairs; also floor coverings of boards or battens, rebated and filleted, ploughed and tongued, and laid folding, with straight or broken joints, beveled or square heading joints.

He should be able to draw in elevation, from given dimensions, a framed partition with door openings.

He should be able to draw in elevation, and give vertical and horizontal sections of solid door frames and window frames.

He should be able to describe, by drawings, beadings of different kinds, dovetailing, cross-grooving, rebating, plough-grooving, chamfering, rounded nosing, and housings.

He should be able to draw in elevation, and give vertical and horizontal sections of, the following doors, viz., ledged, ledged and braced, framed and braced, paneled, and the mode of putting them together, position of hinges and furniture; as well as to describe, by drawing, the following terms as applied to paneled doors, viz., square and flat, bead butt, bead flush, moulded, all on one or both sides.

He should be able to draw in elevation, and to give vertical and horizontal sections of the following window sashes and frames, viz., single or double hung sashes with square, beveled, or moulded bars, and cased frames; casement sashes hung to solid frames, with method of hanging and securing in each case.

He should be able to show, in elevation and section, the lead-work connected wich chimneys, ridges, hips, valleys, gutters, and lead-flats.

He should be able to give an elevation and section of the slating of a roof laid with duchess or countess slates on boards or battens.

He should be acquainted with the proper cross section for cast-iron beams for use in floor girders or bressummers, or as cantilevers; and be able to draw such a section in its right proportions from given dimensions of flanges.

He should be able to draw in elevation, from given dimensions and skeleton diagrams, ordinary iron roofs up to 40 feet span, showing the sections of different parts, and methods of connecting them.

Second Stage, or Advanced Course.

In addition to the subjects enumerated for the Elementary Course—in all of which questions of a more complicated nature may be set, combining work done by the different trades—the knowledge of the students will be tested under the following heads, viz.:—

1st. Freehand sketches explanatory of any details of construction, such as the joints of iron and wooden structures, and other parts requiring illustration on an enlarged scale. These sketches may be roughly drawn, provided they are clear and capable of being readily understood.

2nd. The nature of the stresses to which the different parts of simple structures are subjected, as follows:—

In the case of beams fixed at one end, such as cantilevers, and fixed at both ends, or supported at both ends, as in girders, the student should know which side of the beam is in compression, and which in tension.

He should be acquainted with the best forms for struts, ties, and beams, such as floor joists, exposed to transverse stress.

He should know the difference in the strength of a girder carrying a given load at its centre, or uniformly distributed.

In the ordinary kinds of wooden or iron roof trusses, and framed structures of a similar description, he should be able to distinguish the members in compression from those in tension.

3rd. The nature, application, and characteristic peculiarities of the following materials in ordinary use for building purposes, viz.:—

Bricks of different kinds in common use, York, Portland, Caen, and Bath stones (or stones of a similar description), granite, pure lime, hydraulic lime, Portland and Roman cement, mortars, concretes, grout, asphalte, timber of different kinds in common use, cast and wrought iron, lead.

4th. Constructive details, as follows:—

The ordinary methods of timbering excavations, such as for foundations to walls, or for laying down sewers; the erection of bricklayer's and mason's scaffolding; the construction of travelers; the use of piles in foundations, hoop iron bond in brickwork, diagonal and herring-bone courses in ditto, damp-proof courses, bond timber in walls and the objections to it.

He should know how bricks are laid in hollow walls, window or door openings with splayed jambs, flues, chimneys, fireplaces, and arches up to about 20 feet span; how mortar joints are finished off, and the thickness usually allowed to them; why bricks and stones ought to be wetted before being laid.

He should be acquainted with the construction of brick ashlar walls, rubble ashlar walls, stone stairs, wooden stairs (both dog-legged and open newel), skylights, fire-proof floors (such as brick arches supported on rolled or cast-iron girders, Fox and Barrett's, and Dennett's patent concrete floors), circular and egg-shaped drains, roofs of iron or wood, for spans up to 60 feet; the fixing of architraves, linings and skirtings to walls, shutters to windows, lath, plaster, and battening to walls, roof coverings of tiles and zinc, slate ridges and hips.

Written answers will be required to some of the questions.

Examination for Honours.

The candidate will have to furnish a design for a building, or part of a building, in accordance with given conditions; which design he will be allowed to draw out at his own home.

He will be called upon to answer in writing—illustrated by sketches, either freehand or to scale, as directed—questions on all the subjects previously enumerated for the elementary and advanced Courses.

He must possess a more complete knowledge of building materials, their application, strength, and how to judge of their quality; and in the case of iron, of the processes of manufacture, and the points to be attended to in order to insure sound castings, and good riveting.

He must be able to solve simple problems in the theory of construction, such as in the case of a beam supported at both ends, to ascertain the proportion of the load transmitted to each point of support, and to determine the safe dimensions of iron or wooden beams subjected to dead loads.

In ordinary roof trusses and framed structures of a similar description, he must be able to trace the stresses, brought into action by the load, from the points of application to the points of support, as well as to determine the nature and amount of the stresses on the different members of the truss, and, consequently, the quantity of material required in each part.

In ordinary walls and retaining walls, he must be able to ascertain the conditions necessary to stability, neglecting the strength of the mortar.

Text Books.

	s.	d.
Drawing for Carpenters and Joiners. Davidson. Publisher, Cassell, Petter, and Galpin - - - - - -	3	6

	s.	d.
Building Construction and Architectural Drawing. Davidson. Publisher, Cassell, Petter, and Galpin - - - - -	2	0
The Art of Building. Dobson. (Weale's Series.) Publisher, Virtue and Co. - - - - - - -	1	6
Foundations and Concrete Works. Dobson. (Weale's Series.) Publisher, Virtue and Co. - - - - - -	1	6
Carpentry and Joinery. (Weale's Series.) Publisher, Virtue and Co. - - - - - - - -	1	6
Plates to ditto. (Weale's Series.) Publisher, Virtue and Co. -	4	6
Roofs for Public and Private Buildings. (Weale's Series.) Publisher, Virtue and Co. - - - - - - -	1	6
Iron Roofs of recent Construction, descriptive plates. Virtue and Co. - - - - - - - -	4	6
Masonry and Stone-cutting. Dobson. (Weale's Series.) Publisher, Virtue and Co. - - - - - - -	2	6
Limes, Cements, Mortars, Concretes, Mastics. Burnell. (Weale's Series.) Publisher, Virtue and Co. - - - - -	1	6
Brick and Tile-making. Dobson. (Weale's Series.) Publisher, Virtue and Co. - - - - - - - -	3	0
Exercises on Mechanics and Natural Philosophy. Tate. Publisher, Longman - - - - - - -	2	0

Books of Reference for the General Library.

	£	s.	d.
Gwilt's Encyclopædia of Architecture. Publisher, Longman	2	12	6
Tredgold's Carpentry. (New edition in the press.)			
Ashpitel's Treatise on Architecture. Publisher, Black -	1	10	0
Newland's Carpenters and Joiners' Assistant. Publisher, Blackie - - - - - - - -	2	18	0
Nicholson's Carpentry. Publisher, Kelly.			
Reid on Portland Cement. Publisher, Spon - -	0	12	6
Rankine's Civil Engineering. Publishers, Griffin and Co. -	0	16	0
„ Useful Rules and Tables. Publishers, Griffin and Co. - - - - - - - - -	0	9	0
Humber's Handy Book of Strains. Publisher, Spon -	0	7	6
Sheilds on Strains in Ironwork. Publisher, Weale - -	0	5	0

SUBJECT III. (ALTERNATIVE).—NAVAL ARCHITECTURE.

First Stage or Elementary Course.

Candidates for the elementary course will be required to possess sufficient knowledge of practical ship-building, to apply the various materials used for that purpose to the greatest advantage, such for instance as "shift of butts" for both wood and iron ships. Also to be able to make sketches, to scale, of the component parts of a ship's hull.

Second Stage or Advanced Course.

Candidates for the more advanced course will, in addition to that directed for the elementary course, be required to make detail and working drawings, showing a knowledge of the methods of combining the several parts of a ship's hull. Also to possess a knowledge of laying off on the mould loft floor.

Examination for Honours.

The honours examination will embrace questions relating to the calculation of displacement, in addition to that prescribed for the preceding courses; and the candidates will be required to make a drawing at home, comprising sheer, half-breadth, and body plans, from data which will be furnished.

Neatness and accuracy in drawing will be insisted on.

Text Books.

Rudiments of Naval Architecture, by James Peake (Weale's Series), 12mo., 3*s*. (London, Weale, 1851.)

Shipbuilding in Iron and Steel, by E. J. Reed, 8vo., 30*s*. (London, Murray, 1868.)

Directions for Laying-off Ships, by J. Fincham, 8vo., 5*s*. (London, Whittaker, 1840.)

Outline of Shipbuilding, by J. Fincham, 8vo., 31*s*. 6*d*. (London, Whittaker, 1840.)

Shipbuilding, Theoretical and Practical, edited by W. J. M. Rankine, folio, 84*s*. (London, Mackenzie, 1866.)

For the General Library: *Barlow's Strength of Materials*.

SUBJECTS IV. & V.—MATHEMATICS.

This subject is divided into seven stages, The examination in stages 1, 2, and 3 is taken on one evening; in stages 4 and 5 on another; and in stages 6 and 7 on a third.

A student may in any one year come up on all three evenings, but he may only take up one stage on each evening. The manner in which the subject has been divided under the several stages has been largely dictated by the requirements of the system of the Department as respects payments on results and method of examination. The sequence of the stages is therefore not to be considered strictly as a guide to the student's reading. There is no reason, for instance, why a student should not read the portion of the subject given under stage 4 at the same time or before that given under stage 3.

N.B.—Sufficient questions will always be given in the early portions of each stage to enable a student with a thorough knowledge of them by good answering to obtain a second class.

First Stage.

A certain number of questions will be set which must be attempted; and no candidate will be allowed to pass unless his answer to those questions shows that he possesses sufficient knowledge of the subject to obtain a correct solution.

1. *Arithmetic generally*.—The performance of numerical calculations with accuracy and lucid arrangement, and explanation of the reasons of processes of a simple kind, may be demanded. This branch is mentioned not so much as a separate subject, but because wherever examples are given which involve *numbers*, the complete solution in figures should be given: that it may be

ascertained by the examiner that the candidate can from formulæ in symbols deduce useful numerical results.

Decimal fractions in all cases to be shown (not *vulgar fractions*).

2. *Geometry.*—The properties of lines, triangles, rectilinear figures, as far as they are treated in the 1st Book of Euclid.

The examination questions in this subject will generally be given so as to bring out as far as possible the candidate's knowledge of the principles of geometry. They will not be set in the form of Euclid, but will consist as far as may be of definitions and easy geometrical theorems which can be proved, and problems which can be solved by the application of the well-known properties of triangles, &c. Any solution, whether in the words of Euclid or not, which shows that the candidate possesses an accurate method of geometrical reasoning will be accepted. Candidates should endeavour to draw good figures, and should as much as possible keep the demonstration on the same page with the figure.

3. *Algebra.*—Definitions. Simple rules. Greatest common measure and least common multiple. Integer Indices. Fractions and Reductions. Simple equations and problems producing them.

SECOND STAGE.

All the preceding subjects, with these additions :—

1. *Geometry.*—The relations of rectangles and squares to one another, and the properties of the circle, as far as they are treated in the 2nd and 3rd books of Euclid.

As before defined, answers to questions on this part of Geometry may be given on any system which the student may have followed, provided the reasoning be clear and accurate.

2. *Algebra.*—Quadratic equations and problems producing them. Involution and Evolution. Ratio. Proportion.

3. *Plane Trigonometry.*—Definitions. Modes of measuring angles, by degrees, grades, and circular measure. The goniometric functions, and the conversion of one into another. The meaning of contrariety of signs in trigonometry. Tracing of the goniometric functions in magnitude and algebraic sign through the four quadrants and when an angle is indefinitely increased. The arithmetical values of the goniometric functions of 30°, 45°, 60°, 75°, 90°, &c.

Formulæ for multiplication and division of angles: sine, cosine, tangent, &c., of $(A \pm B)$, $2A$, $3A$, $\frac{A}{2}$, and $\frac{A}{3}$. Also of A and B in terms of sines and cosines of $\frac{A+B}{2}$ and $\frac{A-B}{2}$.

Logarithms.—Definition. Multiplication, Division, Involution and Evolution by logs. The use of logarithmic tables. Tables of proportional parts for numbers and angles.

Triangles.—Formulæ for cosine of an angle of a triangle in terms of its sides. The relation between sines of angles and the opposite sides; sine, cosine, tangent, &c., of half an angle of a triangle in

terms of sides, and of the sine of an angle. Area of a triangle. Solution of triangles. Heights and distances of inaccessible objects.

THIRD STAGE.

All the preceding subjects, with these additions:—

1. *Algebra.* — Permutations and Combinations. Progressions. The Binomial theorem. Complete theory of indices. The Binomial theorem with any index. The multinomial and exponential theorems. Logarithms and logarithmic series, and construction of tables of logarithms.

2. *Plane Trigonometry.*

Diameters of circles inscribed in and circumscribed about a given triangle. Areas of regular polygons inscribed in and circumscribed about a given circle. Area of a circle. Description and use of vernier and theodolite and sextant. Demoivre's theorem for an integral positive index. Expressions for sine, cosine, and tangent of an angle in terms of the angle. The exponential expressions for the sine, cosine, and tangent of an angle, and resulting series. Solution of quadratic and cubic equations by trigonometry.

Or a student may, in place of the preceding trigonometry, take up the elements of spherical trigonometry. Questions will be given in both subjects, but in this stage the student will not be required to answer questions in both to obtain full marks.

3. *Spherical Trigonometry.*

Definitions of great and small circles, angles, and sides of spherical triangles. Relations between the angles and sides of supplemental triangles. The fundamental relations between the trigonometrical ratios of the angles and sides of every spherical triangle. Solution of right-angled, quadrantal, and other spherical triangles. The analogies of Napier and the formulæ of Gauss.

HONOURS.

In the subjects of the three preceding stages of elementary mathematics the principal theorems and their applications are indicated. A well prepared student will know of extensions of these theorems, and their employment in the solution of problems: to enable him to show enlarged reading there will be set on the same evening a paper headed, Examination for Honours.

The subjects being the same, there will be proposed in this paper questions which will be chiefly problems or theorems of the more difficult kind in each part. In algebra, the examples given will require more familiarity with algebraic transformations and include the doctrine of infinite series with extended use of the binomial and its dependent theorems. Indeterminate equations. Method of indeterminate coefficients. Continued fractions. Series. Properties of numbers. In geometry, the questions will chiefly be problems, or may require the aid of trigonometry as well as pure geometry for their complete answer: in trigonometry, besides questions which will exercise the student's

ingenuity and test his familiarity with principles, the subject of angles greater than two right angles, and the relations between trigonometric ratios and all the angles which they indicate, will be included; trigonometric eliminations and transformations and the application of algebra to geometry must be familiar. Trigonometric series and expansions. Construction of the Trigonometric Tables. Formulæ of Verification. Proportional parts, and the calculation of logarithms of trigonometric ratios by series. The properties of regular polyhedrons treated by spherical trigonometry. (Analytical geometry or the equations of the line and circle will not be required, but chiefly the algebraic representation of geometrical ratios.)

Text Books.

The books in which elementary mathematics may be studied are too numerous to be mentioned, but as specimens of good and trustworthy treatises, which may be used with advantage by candidates who have little or no assistance, the following works by Mr. Todhunter may be recommended:—

Algebra for Beginners, 18mo., 2*s*. 6*d*.
(London, Macmillan, new ed., 1867.)
Algebra for the use of Colleges and Schools, 8vo., 7*s*. 6*d*.
(London, Macmillan, 4th ed., 1866.)
Trigonometry for Beginners, 18mo., 2*s*. 6*d*.
(London, Macmillan, 1866.)
Elements of Euclid, 18mo., 3*s*. 6*d*.
(London, Macmillan, new ed., 1864.)
Plane Trigonometry. 8vo., 5*s*. (London, Macmillan, 2nd ed., 1861.)
Spherical Trigonometry. 8vo., 4*s*. 6*d*.
(London, Macmillan, 2nd ed., 1863.)

More advanced students may study with advantage:—
Wood's Elements of Algebra, by T. Lund, 8vo., 12*s*. 6*d*.
(London, Longman, new ed., 1861.)
which contains an abundant supply of examples in Algebra.
Also,—
Arithmetic and Algebra, by Barnard Smith, 8vo., 10*s*. 6*d*.
(London, Macmillan, 7th ed., 1860.)
may be found useful.

Fourth Stage.

Plane Geometry.—Ratio and proportion. The similitude of figures. Proportional division of straight lines. The inscription of regular polygons in circles.

N.B.—A knowledge of the 4th and 6th Books of Euclid's Elements, supplemented by clear notions of the ratio and proportionality of commensurable, as well as of incommensurable magnitudes, will suffice. Correct demonstrations, however, derived from any other source will be accepted.

Solid Geometry.—The properties of straight lines and planes; their intersections, inclinations, parallelism, perpendicularity, &c.

Trihedral and polyhedral angles. Prisms, pyramids, and polyhedrons; their definitions, plane sections, similitude, &c.; their quadrature and cubature.

Elementary properties of the sphere, and of cylinders and cones with circular bases; their plane sections, tangent planes, surfaces, and volumes.

Descriptive Geometry.—Representation of points, straight lines, and planes, by projections and traces on two orthogonal planes. The use of auxiliary projections and rabatments. Graphic solutions of problems concerning straight lines and planes; their intersections, inclinations, &c. Problems on trihedral angles.

Geometrical Conics.—Properties of the parabola, ellipse, and hyperbola deduced by pure geometry from definitions *in plano*.

FIFTH STAGE.

The preceding subjects of the fourth stage, together with the following:—

Descriptive Geometry.—Problems concerning spheres, cylinders, cones, and simpler surfaces of revolution; their intersections by straight lines, by planes, and by one another; their tangent planes and normals, &c.

Spherical Trigonometry.—Definitions. Great and small circles. Angles and sides of spherical triangles. Relations between the angles and sides of supplemental triangles. The fundamental relations between the trigonometrical ratios of the angles and sides of every spherical triangle. Solution of right-angled, quadrantal, and other spherical triangles. The radii of their in- and circumscribed circles. The analogies of Napier and the formulæ of Gauss.

Co-ordinate Geometry.—Rectangular, oblique, and polar co-ordinates of a point, and transformations from one system of such co-ordinates to another.

Equations of straight lines, and the treatment of questions relative to their intersection, concurrence, inclination, parallelism, perpendicularity, &c.

Equations of circles, their tangents, and normals. Elementary properties of poles and polars relative to the circle. Questions concerning the intersection of circles, and the determination of circles which satisfy given conditions.

The simpler forms of the equations of the parabola, ellipse, and hyperbola, as determined from various definitions of those curves. The equations of their tangents and normals. The principal properties of their diameters, axes, foci, conjugate diameters, asymptotes, poles, and polars.

Discussion of the general equation of the second degree referred to oblique or to rectangular co-ordinate axes.

Co-ordinate Geometry of three Dimensions.—Co-ordinates of a point referred to oblique or to rectangular co-ordinate axes. Direction-angles of straight lines. Inclination of two straight lines. Locus of points whose co-ordinates satisfy a given equation, or two given equations. Equations of planes and of straight lines. Determination of their inclinations, and of the conditions of their parallelism and perpendicularity. Treatment of questions concerning straight lines and planes.

HONOURS.

In the examination for honours, questions will be proposed whose treatment requires a more extended knowledge of the foregoing subjects, and an acquaintance with more general methods of investigation. In pure geometry, for instance, some knowledge of harmonic, as well as of anharmonic ratios, of the generation of conics by homographic rows of points and pencils of lines, and of the descriptive properties of these curves as thus deduced will be desirable. In co-ordinate geometry,

again, opportunities will be given of exhibiting a knowledge of the use of abridged methods of notation, of homogeneous point-co-ordinates and line-co-ordinates, and of the modes of investigating thereby some of the simpler properties and singularities of higher plane curves.

In co-ordinate geometry of three dimensions a knowledge of the classification and fundamental properties of surfaces of the second order will be demanded.

Text Books.

Amongst the works on the subjects of the 4th and 5th stages which may be read with advantage, the following may be cited:—Dr. Woolley's Elements of Descriptive Geometry; Todhunter's Spherical Trigonometry; Geometrical Conics by Drew, Taylor, or Besant; Dr. Salmon's Treatises on Conics and on Higher Plane Curves; Townsend's or Mulcahy's Modern Geometry; Frost and Wolstenholme's Solid Geometry.

Sixth Stage.

Differential Calculus.—Definitions. Limits. Differential coefficients. Differentiation of simple functions, of inverse functions. Successive differentiation of functions of one variable. Taylor's and Maclaurin's Theorems and their simpler applications. Determination of values of functions when indeterminate in form. Differentiation of a function of a function and of implicit functions. Maxima and minima of functions of one independent variable.

Applications of the preceding to the geometry of plane curves referred to rectangular or to polar co-ordinates. Tangents, normals, sub-tangents, sub-normals, asymptotes. Multiple and singular points. Contact and curvature. Tracing of curves. Differential coefficients of arcs and areas of plane curves, and of the surfaces and volumes of solids of revolution.

Integral Calculus.—Meaning of definite and indefinite integration. Integration of the more frequently occurring functions. Integration by parts. Rational fractions. Formulæ of reduction.

Applications to the rectification and quadrature of plane curves referred to rectangular and polar co-ordinates, as well as to the quadrature of surfaces of revolution.

Seventh Stage.

Differential Calculus.—In addition to the subjects of the sixth stage the following:—Differentiation of functions of two or more independent variables. Lagrange's and Laplace's Theorems. Change of independent variables. Expansion of functions of more than one independent variable. Maxima and minima of such functions. Elimination of functions.

Geometrical applications of the calculus. Involutes and evolutes of plane curves. Envelopes of curves and surfaces. Tangent planes and normals to surfaces. Tangents and normal planes to curves of double curvature. Differential coefficients of the arcs of such curves, as well as of the surfaces and volumes of solids.

Integral Calculus.—Double and triple integrals. Applications of the calculus to the quadrature of curved surfaces and the cubature of solids. Change of variables in a multiple integral. Definite integrals; their differentiation and simpler properties. Definitions

and elementary properties of elliptic integrals and elliptic functions. Eulerian integrals. Gamma functions.

Differential Equations.—Their nature, origin, and classification. Integrable forms of differential equations of first order and degree. Integrating factors. Riccati's equation. The methods of integrating differential equations of first order, but not of first degree. Linear differential equations. Integration of them by symbolical methods when the coefficients are constant. Singular solutions of differential equations. Ordinary differential equations with more than two variables. Simultaneous differential equations. The nature and origin of partial differential equations. Integration of the simpler forms.

Geometrical applications to the theory of curved surfaces.

Calculus of Finite Differences.—Nature and object of the calculus. Definitions of its symbols and terminology. Differences of elementary functions. Expansion by factorials. Meaning of generating functions. Relations between successive values and differences. Differences of zero. Meaning of integration. Easy applications of the calculus to interpolation and the summation of series.

Honours.

In the examinations for Honours, the range of subjects will be almost the same; but the questions proposed will be of a higher order of difficulty. A more extended knowledge of the applications of the calculus to the theory of surfaces will also be demanded.

Text Books.

The following works may be read with advantage:—

Dr. Salmon's Higher Algebra, Higher Plane Curves, and Analytic Geometry of three Dimensions.

Boole's Treatises on Differential Equations and on Finite Differences.

Todhunter's Treatises on the Differential, and on the Integral Calculus.

Calcul Differentiel et Integral, par Lerret.

Traité du Calcul Differentiel et Integral, par Bertrand.

SUBJECT VI.—THEORETICAL MECHANICS.

First Stage or Elementary Course.

The student who takes up this course is expected to give clear and full statements of the principles of the science, and to show that he understands them by answering easy questions on their applications. These questions will not demand for their solution a knowledge of mathematics beyond the elements of algebra, mensuration, and geometrical constructions by scales and compasses. The formal proof of theorems will not be required except in the cases specified below:—

A.—*Statics.*

(1.) The composition and resolution of forces and the conditions of their equilibrium, viz., the parallelogram, triangle, and polygon of forces. Parallel forces. The principle of moments.

(2.) Physical properties of solids; hardness, elasticity, tenacity.

(3.) Centre of gravity. Its position in the case of a straight line, parallelogram, circle, triangle, sphere, pyramid, and cone, of uniform density; and in the case of several heavy points.

(4.) Reaction of a fixed point or fulcrum. Equilibrium of a body capable of turning round a fixed point; levers; the balance, and its sensibility; the steel-yard.

(5.) Transmission of force through a rigid body and along a perfectly flexible thread. The single pulley. Simpler combinations of pulleys.

(6.) Reaction of smooth and rough surfaces; the limiting angle of resistance, or angle of repose; the coefficient of friction; the laws of friction.

(7.) Conditions of equilibrium of a body resting under the action of forces on a plane whether smooth or rough, horizontal or inclined; equilibrium of a wall sustaining an oblique thrust; buttresses.

(8.) Stable and unstable equilibrium.

(9.) Unit of work, and horse power; simple questions as to the working power of agents; the modulus of a machine.

B.—*Dynamics*.

(10.) Measure of time, distance and velocity—uniform or variable. The accelerative effect of a constant force, and particularly that of gravity. Relations between space, velocity and time in the case of the rectilinear motion of bodies whose velocities are uniformly accelerated. Composition of velocities.

(11.) Definitions of mass, momentum, moving force and of vis viva, energy or accumulated work. The laws of motion. The absolute unit of force.

(12.) Rectilinear motion of a body under the action of given forces; Atwood's machine; motion on an inclined plane, and in a circle; centrifugal force; time of small oscillation of a simple pendulum. Centre of oscillation of an oscillating body.

(13.) Impulsive forces; velocity after direct impact of spheres; transformation (or loss) of accumulated work in collision.

C.—*Hydrostatics and Pneumatics*.

(14.) Law of transmission of pressure through a fluid; pressure of a fluid against a plane area; the centre of pressure; equilibrium of a reservoir wall.

(15.) Pressure of a fluid on a body wholly or partly immersed. Specific gravity of a solid or liquid; and the simpler cases of its determination. Conditions of equilibrium of a floating body. The metacentre. Conditions of stability of a floating body.

(16.) Experiments which show that air is an elastic fluid; the Magdeburg hemispheres; the cistern barometer; Boyle's experiment. Relation between pressure, temperature, and volume of a gas.

(17.) Well known machines and the principles of their construction; the hydraulic press; the specific gravity balance; the hydrometer; Nicholson's hydrometer; the specific gravity bottle; the ordinary suction and forcing pumps; the syphon; the air pump.

The student should be able, if required, to prove:—

(*a.*) The rule for determining the *magnitude* of the resultant of two intersecting forces, assuming the rule for its *direction*.

(*b*.) The rule for determining the resultant of two parallel forces.

(c.) That the sum of the moments of two intersecting forces with reference to any point in their plane, equals the moment of their resultant with respect to the same point.

(*d*.) The rule for finding the centre of gravity of a triangle.

(*e*.) The formulæ for uniformly acclerated rectilinear motion, viz. :—

$$v = V + ft. \qquad s = Vt + \tfrac{1}{2}ft^2. \qquad v^2 = V^2 + 2fs.$$

(*f*.) The formula for the *vis viva* of, or *work accumulated* in a moving body, viz., $\frac{1}{2}\,mv^2$ or $\frac{wv^2}{2g}$.

(*g*.) That the pressure of a fluid on a body wholly or partly immersed equals the weight of the fluid displaced, and acts vertically upward through the centre of gravity of the immersed part of the body supposed of uniform density.

Second Stage or Advanced Course.

The student who takes up the second or advanced course is expected to be able to prove the fundamental theorems of mechanics, so far as the subject is included in the elementary course, and to work somewhat harder examples; thus :—In the elementary examination he might be asked to explain what is meant by "centrifugal force," and to work an easy example on the formula $F = \frac{mv^2}{r}$; in the advanced examination he might be asked to prove this formula as well as to work a somewhat harder example. He is also expected to understand certain parts of the subject not included in the elementary course, viz. :—

(1.) Properties of statical couples, and proof and applications of the equations of equilibrium of forces acting in one plane.

(2.) Conditions of equilibrium of simple machines when the friction of the parts is taken into account. Inclined plane, wedge, screw, pulleys, bodies capable of turning round an axle of finite radius.

(3.) The principle of virtual velocities and its application to machines in a state of uniform motion. Dynamometers.

(4.) Motion on rough inclined and horizontal planes. Motion of projectiles.

(5.) Moment of inertia. Effective forces. D'Alembert's principle. Resultant of effective forces and work accumulated in the case of a body turning round a fixed line. The fly wheel. The compound pendulum.

(6.) Oblique impact. Centre of percussion. The ballistic pendulum.

(7.) Calculation of heights by barometer. The aneroid barometer.

(8.) Motion of fluids through orifices, pipes, and open channels.

(9.) Capillary attraction.

Examination for Honours.

The details of the course for this examination need not be specified, but it must be understood that the student should be prepared to answer questions on every branch of the subject as usually taught in the higher classes in colleges. In addition to the careful study of the usual textbooks, such as Todhunter's *Analytical Statics*, Routh's or Griffin's *Rigid Dynamics*, Besant's or Miller's *Hydrostatics*, the student will find it very useful to study some work in which the subject is treated from a some-

what less exclusively mathematical point of view, such as the first 19 chapters of Jamin's *Cours de Physique*, Morin's *Notions fondamentales de Mécanique*, the first division of Thomson and Tait's *Natural Philosophy*, &c. The applications of abstract mechanics to questions of construction, &c. can be studied in Moseley's *Mechanical Principles of Engineering and Architecture*, and in Rankine's *Applied Mechanics*. It cannot be too strongly impressed on the student's attention that the study of the higher branches of mechanics can only be attempted with profit when it is preceded by a thorough knowledge of the elements; of so much, for instance, as is comprised in the first and second courses.

Text Books.

As text books for the elementary and advanced courses the following may be mentioned:—

(*a*). For Statics and Dynamics:

Mechanics for Beginners, by I. Todhunter, 18mo., 4*s.* 6*d.* (London, Macmillan, 1867.)

Elementary Statics and Dynamics, by H. Goodwin, 12mo., 6*s.* (London, Bell and Daldy.)

Elementary Introduction to Practical Mechanics, by J. F. Twisden, 8vo., 10*s.* 6*d.* (London, Longman.)

(*b*). For Hydrostatics and Pneumatics:—

Manual of Hydrostatics, by J. A. Galbraith and S. Haughton, 12mo., 2*s.* (London, Longman.)

Elementary Hydrostatics, by W. H. Besant, 12mo., 4*s.* (London, Bell and Daldy.)

It will, of course, be understood that the student will in most cases find it best to master one text book in each subject, and then, if he find it necessary, refer to others for information on particular points. He will find it instructive to read attentively the parts of either of the following books which treat of the present subject:—

An Introduction to the study of Natural Philosophy, by C. Brooke, 12mo., 12*s.* 6*d.* (London, Churchill.)

Ganot's Experimental and Applied Physics, translated by E. Atkinson, 8vo., 15*s.* (London, Longman, 3rd ed., 1868.)

For the course for the honour examination the following works may be mentioned:—

Analytical Statics with numerous examples, by I. Todhunter, 8vo., 10*s.* 6*d.* (London, Macmillan, 3rd ed., 1866.)

Dynamics of a System of Rigid Bodies, by E. J. Routh, 8vo., 10*s.* 6*d.* (London, Macmillan, 1860.)

Treatise on the Motion of a Rigid Body, by W. N. Griffin, 8vo., 6*s.* 6*d.* (London, Parker and Son, 1847.)

Treatise on Hydro Mechanics, by W. H. Besant, 8vo., 10*s.* 6*d.* (London, Bell and Daldy, 2nd ed., 1868.)

Elements of Hydrostatics and Hydrodynamics, by W. H. Miller, 8vo., 6*s.* (Cambridge, Deighton, 4th ed., 1850.)

The student's attention will in the first place be mainly directed to the above text books, but it will be a great advantage to him to be able to consult some or all of the following works, and to study parts of them, viz.:—

Lectures on Natural Philosophy, by Thomas Young.

Cours de Physique de l'Ecole Polytechnique, par J. Jamin, 3 vols. 8vo., 1*l*. 8*s*. 6*d*. (Paris, Mallet-Bachelier, 2nd ed.)
Treatise on Natural Philosophy, by W. Thompson and P. G. Tait, Vol. I., 8vo., 24*s*. (Oxford.)
Poinsot's Elément de Statique, 8vo., 1 vol.
Poisson Traité de Mécanique, 8vo., 2 vols.
Poncelet, Introduction à la Méchanical Industrielle, 8vo., 1 vol.
Notions fondamentales de Mécanique et données d'expérience, par A. Morın, 5 plates, 8vo. (Paris, Hachette, 1860.)
Mechanical Principles of Engineering and Architecture, by H. Moseley, 8vo., 24*s*. (London, Longman.)
Manual of Applied Mechanics, by W. J. M. Rankine, 12*s*. 6*d*. (London, Griffin.)
Collection of Problems in illustration of the Principles of Theoretical Mechanics, by W. Watton, 8vo. (Cambridge.)

SUBJECT VII.—MECHANICS AS AN ART OR APPLIED MECHANICS.

NOTE.—*The Steam Engine is treated as a special subject.* (*See Subject* XXII.)

The subject of applied mechanics is here assumed to be the application of mechanical philosophy by the aid of mechanical art. That there are certain mechanical principles existing in nature which are turned to practical account by means of differently constructed mechanical contrivances in order to accomplish a definite object.

This subject therefore embraces, first, the natural laws or principles that have to be applied, and secondly, the means employed for their application. The mechanical means or appliances that are thus employed cover a wide field, and in the most limited sense include the nature and chief characteristics of the materials that are used in mechanical operations to be fashioned into the required forms. The arranging and combining of these forms into a structure, in such a manner that on the application of force certain definite results will be obtained thereby.

From the foregoing definition it will be seen that applied mechanics has a two-fold character, a mechanical art and scientific principles. The first is chiefly founded on a long accumulation of facts originating in the workshop; this practical part will be found the most difficult to teach, because few books have been written on the subject, and there is no book which treats the subject as a whole. On the scientific principles there are many books, but the greater nunber are too mathematical for the class of elementary students at the present time. If such books however are studied by the teachers, they will be able to explain the nature of the laws upon which facts depend. The teachers are recommended to read the Cantor Lectures on Applied Mechanics given at the Society of Arts in 1869.

This syllabus is arranged for three classes of candidates; the first is elementary in its character, and may be considered as a stepping-stone to the second or more advanced class; it is intended for the guidance

of the first or elementary class of candidates, who will be expected to have a fair knowledge of most of the branches enumerated, and to be able to give a precise and satisfactory answer on any of them, or to make clear well-drawn hand sketches where such may be necessary for explanation.

The second part is intended for those in the more advanced class, who will be expected to have a thorough knowledge of all the subjects referred to in the syllabus for the elementary class, and, in addition, to have a fair understanding of the application of the principles in actual practice.

The third part is intended for candidates coming forward for "Honours examination," who will be expected to have a complete knowledge of the questions referred to in the two former parts of the syllabus, and, in addition, to have some acquaintance with the higher theoretical principles that are required for the close investigation of the foregoing or more practical part of the subject.

As the chief object of these examinations is to foster the education of young men for the practical duties of life in connexion with the engineering and manufacturing industries of the kingdom, it is intended that the examination in applied mechanics shall be in accordance therewith so far as may be practicable.

First Stage or Elementary Course.

Candidates for the first course will require to have a fair knowledge of the more common materials that are employed in the arts, and likewise some acquaintance with the general principles of the processes by which they are severally changed in their condition and form, in order to adapt them for practical purposes.

The students should have explained to them the leading principles that determine strength as derived from the form or shape of a beam, pillar, &c.; this will greatly facilitate the after teaching.

They should be familiar with the several mechanical powers, and the combination of these powers into simple machines.

They should know the nature of the various mechanical contrivances that have been designed for changing the condition, direction, or rate of motion, as well as the means employed for its regulation by fly-wheels, governors, and such like. This division will embrace toothed gear shafting, cams, fast and loose pullies, endless bands, and all such appliances.

The elementary students ought to be well grounded in the laws which govern matter in motion, viz., force, energy, momentum, &c., and especially in the nature of mechanical "work," which they ought to be able to apply to all the ordinary purposes of mechanical operations, and to work out in arithmetic.

They should know the laws of friction, and be made acquainted with the various means that are resorted to in order to modify its effect in mechanical apparatus.

Second Stage or Advanced Course.

Candidates in the second stage, or advanced course, should have a thorough knowledge of all the subjects laid down for the elementary stage, and in addition should be well grounded in the strength of materials,

and the reasons that determine the selection of certain materials for particular purposes, and have clearly pointed out to them the respective advantages and disadvantages as due to their several characteristics.

They should understand and be able to describe all kinds of common machinery, such as cranes, machines for weighing, a corn mill, a clock, a coffee mill, or other familiar apparatus.

The candidates should have explained to them the nature of a flat surface or perfect plane, likewise of a true circle, and correct measurement, and the means by which such conditions are obtained.

They should be acquainted with the natural laws that govern fluids, such as air and water, and the different kinds of apparatus that have been contrived in order to apply those fluids to the various purposes of civilization. This division will include water-wheels, turbines, water engines, hydraulic apparatus in its various applications to pumping, pressing, cranes, &c., air blowing, bellows, fan, Roots blower, air compressing and exhausting apparatus, and the usual operations to which they are severally applied.

They should know the general principles of mechanical construction in the engineering workshops, and the operations in connexion therewith, both of the foundry and smithery; likewise the principles upon which the various tools and implements depend for their efficacy.

They should have some acquaintance with the leading manufactures of the country, such as iron and steel, cotton, paper, and printing, and be able to give a fair description of the several processes, as well as the principles upon which they depend.

Examination for Honours.

The foregoing syllabus will sufficiently indicate the nature of subjects that will form the basis for the Examination in Honours in Applied Mechanics. It will be expected, however, that the candidate, in addition to being able to give an intelligent answer to the various questions, and to make hand sketches of such parts as may be required, shall be thoroughly grounded in the laws of nature, so far as they relate to the philosophical and mathematical principles on which the various branches of applied mechanics are founded, and the candidate should not only be familiar with the formulæ, but should be able to refer back to the data from which they are derived.

Text Books.

The following books may be mentioned for the elementary class:—

Exercises on Mechanics and Natural Philosophy, by Thomas Tate. (Longman.)
Elements of Mechanism, by T. Baker, C.E. (Weale's Series.)
Rudimentary and Elementary Principles of the Construction and of the Working of Machinery, by C. D. Abel, C.E. (Weale's Series.)

For the advanced class the following books may be mentioned:—

Elements of Mechanism, by T. M. Goodeve. New edition.
The Power of Water, by Joseph Glynn, F.R.S. (Weale's Series.)
Useful Information for Engineers, by Sir W. Fairbairn, Bart.
Mills and Millwork, by Sir W. Fairbairn, Bart.
Ganot's Elementary Treatise on Physics.

For students for honours the following :—

Enquiry and Experiments on the Strength of Wrought-iron and Steel, by D. Kirkaldy.
Treatise on the Strength of Materials, by Peter Barlow.
Machinery and Millwork, by Professor Rankine.

Books of reference for all classes of students :—

Turning and Mechanical Manipulation, by C. Holtzapffel.
Engineer and Machinist's Assistant. (Blackie.)
Useful Metals and their Alloys. (Houlston.)
Moulder's and Founder's Pocket Guide, by F. Overman.
On the Management of Steel, by G. Ede.

SUBJECT VIII.—ACOUSTICS, LIGHT AND HEAT.

First Stage or Elementary Course.

Questions will be confined to the following subjects :—

Acoustics.

The pupil ought to have a perfectly clear notion of the manner in which a *wave* is propagated.

He ought to know what is meant by the terms density and elasticity as applied to air and other bodies, and how heat and cold affect the density and elasticity of air.

He ought to be able to describe simple experiments to prove that air possesses both weight and elasticity. He ought to understand the law of Marriotte, the construction and use of the air pump, and what occurs when a sounding body is placed in a space from which the air has been withdrawn.

He ought to be taught to see the play of elasticity in the propagation of a sonorous wave through air, and to have a clear mental image of the condensation and rarefaction which make up such a wave. He must, of course, be able to distinguish between the motion of a wave and the motion of the particles which at any moment form the wave.

He ought to know how the velocity of a wave is affected by a change of density, by a change of elasticity, or by a change of both.

He ought to know the velocity of sound in air of the freezing temperature, and also the amount of augmentation of velocity for every degree of the thermometer. The temperature of the air being given, he ought to be able to calculate the velocity of sound through it, and the velocity of sound being given he ought to be able to calculate the temperature of the air.

No doubt or confusion must rest within his mind regarding the meaning of the terms *velocity*, *intensity*, and *amplitude*. He ought also to know the relation of the two last to each other.

He ought to know the laws of the reflection of sound by tubes and mirrors, and to be able to apply his knowledge to the explanation of echoes.

The law of inverse squares as applied to sound, ought also to be explained to the pupil.

He ought to be able to figure mentally the propagation of a sound-wave through solids and liquids as clearly as through air; to know the velocity of sound through water, and to be able to infer from this the relation of the density of the liquid to its elasticity.

He ought to know how the velocity of sound through air has been determined, and to be well exercised in the calculation of distances by means of light and sound.

The pupil ought to know the physical difference between music and noise, and to be able to state the conditions on which the pitch and the intensity of musical sounds depend. He ought also to be able to describe various methods of producing musical sounds.

He ought to have clear ideas of the *length* of a wave, and of the *time* of a vibration. The length of a wave at a definite temperature being given he ought to be able to calculate the time of a vibration, and the time of a vibration being given he ought to be able to calculate the length of the wave.

He ought to be able to describe a method of determining from the pitch of a sound the number of vibrations per second which produce it.

He ought to know the structure of the drum of the ear, including the membranes that close it, and the bones that cross it.

He ought to know the laws of the vibration of strings, and to understand the use of sound boards in stringed instruments.

He must have a clear notion of the formation of *nodes* upon a string, by the coalescence of direct and reflected waves.

He ought also to know the laws of vibration of columns of air in both stopped and open pipes. The exact condition of the air when the fundamental notes of each class of pipes is sounded, ought to be clearly present in the pupil's mind.

The cause of beats in music ought also to be explained to the pupil, and he ought to know the range of the human ear for musical sounds.

Light.

Before entering upon the subject of light, the teacher will have been careful to make his pupil perfectly familiar with the conception of waves of sound impinging upon the tympanic membrane, and the transmission of the tremor thus produced to the auditory nerve. He need not attempt to enter upon the details of this transference to the nerve, but up to the tympanic membrane, and including it, the idea formed by the pupil of sound waves and their action must be perfectly distinct. In all cases an image must exist corresponding to the teacher's words.

He must understand that the sensation of light is caused by something that hits the optic nerve. That this something, whatever it be, passes through the humours of the eye to reach the nerve behind. The conception of light known as the emission theory can afterwards be made clear to the pupil. According to this theory a ray of light would be a train of these particles.

That a ray of light proceeds in a straight line must be made known to the pupil. In connection with this point the inversion of objects by rays passing through small apertures must be explained.

The mode of determining the velocity of light by the eclipses of Jupiter's satellites must be explained to the pupil.

The law of inverse squares must be illustrated.

The cause of shadows and penumbræ must be explained.

The mode of determining the relative intensities of two lights by means of the "shadow test" must be explained.

The reflection of light from plane mirrors must be explained.

The pupil's attention must be drawn to the lateral inversion of objects by plane mirrors. He must know how the distance of an image behind a looking glass is affected by a change of position of the glass in a direction perpendicular to its own planes.

The relation between the angular velocity of a reflected ray and the mirror that reflects it must be explained to the pupil. The multiplication of images by angular mirrors ought also to be explained, and from it the appearances of the kaleidoscope rendered intelligible.

The formation of images by a concave spherical mirror ought to be explained to the pupil. The axis, principal focus, and centre of the mirror are to be pointed out. Beginning with a luminous point placed beyond the centre, and upon the axis, the successive positions of the image of this point during its motion along the axis from a great distance through the centre through the principal focus, up to the surface of the mirror itself must be determinable by the pupil. He will then be taught to determine the position of the images of points not placed on the axis. Objects of sensible dimensions, such as the pupil's own body, must then be substituted for points. (The teacher will avail himself of such simple apparatus as he can command in the explanations here referred to; a silver spoon, if he possesses nothing better, will be useful.)

Real and *virtual foci* are to be defined.

The "aberration" of a large spherical mirror must be explained.

The refraction of light must be explained. By means of a simple geometrical construction the meaning of the "index of refraction" may be explained to the pupil without the introduction of the term "sine."

It must be clearly explained that an object looked at with a single eye appears more near the greater the divergence is of the rays which reach the eye from the various points of the object. From this it will be inferred that a lake or river, the bottom of which is visible, appears more shallow than it really is.

Various simple, but instructive illustrations of the effects of refraction will occur to the teacher, such, for example, as the rendering of a coin visible by pouring water into a basin, and the apparent bending of a straight stick thrust obliquely into water.

The circumstances under which *total reflection* occurs must be clearly explained to the pupil.

The power and action of lenses must be explained; the teacher will define the *principal focus* of a lens. As in the case of a spherical mirror, he will begin with a luminous point, determining the position and character of its image, while it moves from a great distance up to the lens itself. He will pass from points to objects of sensible dimensions, and show how the position of the image of every point of such object may be determined.

Here also *real* and *virtual foci* are to be explained.

The explanation of the magic lantern is then to be introduced.

It would add much to the efficiency of the instruction if the teacher would illustrate the points here referred to by common spectacle lenses, provided he has nothing better.

The pupil in the first class is also in a condition to know what is meant by the spherical aberration of a lens.

He must understand the optical structure of the eye, be able to give a clear account of the conditions of distinct vision, and of the causes and remedies of long and short sight.

He ought to be acquainted with the fact that impressions persist upon the retina, and to know what is meant by irradiation.

He ought to know the principles of binocular vision, and to clearly comprehend how the impression of solidity is produced by the stereoscope.

He ought to be made acquainted with the composite character of white light; and to be able to describe an experiment by which such light may be resolved into its coloured constituents.

He ought to understand the doctrine of colours as far as they are produced by absorption.

And he ought to understand the meaning of *chromatic aberration.*

Finally, it is to be stated to the pupil that according to our best knowledge the sensation of light is not produced by the impact of little particles darted out from luminous bodies; but that it is caused in a manner somewhat similar to the sensation of sound, namely, by the successive shocks of minute waves against the retina.

Heat.

The pupil should know the general effect of heat upon the volumes of bodies, and should be able to describe experiments illustrative of the expansion of solids by heat. He ought also to have an idea of the almost irresistible force of this expansion.

He ought to understand with perfect clearness what is meant by the *coefficient of expansion,* linear, superficial, and cubical.

He ought to know by heart the coefficients of expansion of gold, silver, platinum, iron, and glass; and the reason why it is possible to fuse platinum wire into glass without fracture on cooling.

He ought to know the principle of Breguet's metallic thermometer, and to be made acquainted with some of the precautions which changes of volume by heat and cold render necessary in the arts.

He ought to be able to describe and explain the gridiron pendulum.

He must be able to describe the construction and explain the use of the mercurial thermometer; the scales of Fahrenheit, Celsius, and Reaumur must be known to him, and he must be able to convert immediately the readings of any one of them into those of the other.

The dependence of the boiling point of water upon external pressure ought to be known, and the pupil must be able to give illustrations of this dependence.

He ought to know by heart the coefficients of expansion of water, alcohol, and mercury.

The pupil must be well acquainted with what is called the *maximum density* of water, to state at what temperature it occurs, and to point out its effects in nature.

He ought to be acquainted with the change of volume which occurs when water passes from the liquid to the solid state, and to apply his knowledge to the bursting of water-pipes in frosty weather. He ought to be acquainted with the fact that expansion on solidification is not a property peculiar to water.

He ought to be able to describe experiments which shall illustrate the expansion of gases. The principle and action of the fire-balloon ought to be explained to the pupil.

The general principles of ventilation ought also to be known to him, and also the sun's action in the generation of winds. He ought to be able to explain the Trade Winds.

The constancy of the coefficient of expansion of gases ought to be pointed out, with the small deviations from the general rule exhibited by carbonic and sulphurous acids. The chemical and physical character of these gases ought to be known to the pupil.

He ought to know the constitution, chemical and physical, of aqueous vapour, and how it is diffused in the atmosphere. He ought to know the meaning of the term *saturated* as applied to air charged with vapour.

The effect of expansion in chilling air ought to be known to the pupil, and also the condensation of the aqueous vapour diffused through the air in consequence of such a chill.

He ought to be able to see the application of this knowledge to the explanation of clouds and rain.

He ought to have a perfectly clear idea of what is meant by *specific heat* or *capacity for heat*, and to be able to describe the calorimeter of Lavoisier and Laplace. He ought to know by heart the specific heats of water, alcohol, mercury, iron, and lead; and to be made aware of the influence which the high specific heat of water exercises upon climate.

He ought also to be intimately acquainted with the facts covered by the term *latent heat*. Taking a block of ice at a temperature below the freezing point, he ought to be able to describe with perfect accuracy what occurs when the temperature of the substance is raised until it liquifies, boils, and is converted into vapour.

The latent heat of water, as expressed on the Fahrenheit and centigrade scales, ought to be in the pupil's memory.

The cold of evaporation and its effect in freezing water in the cryophorus ought to be known to the pupil.

He ought to be exercised in calculations on the changes of temperature due to the mixture of steam and water in various proportions.

The pupil ought to know what is meant by the *conduction* of heat, and must be able clearly to distinguish it from the distribution of heat by *convection*. He ought to know by heart the numbers expressing the relative conductivity of gold, silver, copper, iron, and lead.

He ought to be acquainted with the low power of conduction of organic substances; to know the effect of mechanical texture on the transmission of heat, and to explain the function of clothes in preserving the body from cold.

He ought to be acquainted with the character and phenomena of combustion; to be able to explain the chemical actions which occur in the combustion of coal and of ordinary gas, and to explain the manner in which a candle flame receives its supply of combustible matter.

The combustion of the diamond and Newton's prediction regarding it ought to be known to the pupil. That animal heat is due to slow combustion ought also to be made known.

The structure of an ordinary gas flame ought to be pointed out, and the cause of the difference between this flame and that of a Bunsen's burner explained.

The pupil must be acquainted with the general phenomena of *radiant heat*. The similarity between the phenomena of radiant heat and those of light, as regards reflection and refraction, ought to be known to the pupil.

The different powers possessed by different substances to radiate heat ought to be pointed out, and this knowledge ought to be applied in

explaining the striking fact that the cooling of a vessel may, under certain circumstances, be hastened by surrounding it with flannel.

The reciprocity of radiation and absorption ought to be known to the pupil.

He ought also to know what is meant by the term *diathermancy*, and to be able to point how this property is manifested by different bodies.

Second Stage or Advanced Course.

Questions may be set in all Subjects enumerated under the Elementary Stage, and in addition on the following topics:—

Acoustics.

The second course in acoustics includes an intimate knowledge of all the subjects mentioned in the first. In addition to this a knowledge of the following subjects will be required:—

The augmentation of the velocity of propagation of a wave of sound through air by the condensation and rarefaction of the sound wave itself.

Harmonic tones, their generation and their function in music.

The laws which regulate the transverse vibrations of rods.

The vibrations possible to a tuning fork, a disk, and a bell.

The formation of Chladni's figures.

The laws which regulate the longitudinal vibrations of strings and rods. By a comparison of the notes emitted by a rod and a column of air the pupil ought to be able to determine the relative velocities of sound through both substances.

The conditions and cause of resonance ought to be known to the pupil.

He ought also to know how sounds are produced by the vocal organs of man, and to see clearly the similarity between such sounds and those of the syren. As a case of the same kind, the construction and explanation of the Eolian harp ought also to be known to the pupil.

He ought to be well acquainted with the principles of interference as applied to sound.

He ought to be acquainted with the principles of harmony, to know the ratios of the vibrations corresponding to the notes of the gamut, to be able to give a clear account of the bearing of interference upon the question of consonance or dissonance, and to explain why those ratios which are represented by small whole numbers correspond to the most perfect harmony.

Light.

The candidate in the second course must be intimately acquainted with all the subjects mentioned in the first.

He must be able to apply his knowledge of total reflection to the explanation of the mirage of the desert.

He must be able to describe experiments by which white light may be produced by the admixture of its constituents.

He must know what is meant by *achromatism.*

He must be able to give a clear description of the undulatory theory, and to state how the colours of the spectrum are accounted for by that theory.

He must be able to define a ray of light in accordance with the undulatory theory.

He must be able to show how the reflection and refraction of light occur according to the undulatory theory.

He must be able to describe the appearances presented when incandescent metallic vapours are analysed by the prism. Especially must he be able to state what occurs when a sodium flame is thus analysed.

He must also be able to state what occurs when white light is transmitted through a sodium flame, and he must be able to describe an experiment which shall render manifest what occurs.

He must be able to state generally the relation that subsists between radiation and absorption by gases and vapours.

The lines of Fraunhofer must be known to the pupil, and from this knowledge in conjunction with the knowledge demanded by the foregoing paragraphs, he must be able to infer the probable constitution of the sun.

The pupil ought also to know the principles of interference as applied to light.

He ought to be able, in accordance with these principles, to account for the colours of thin plates and of striated surfaces.

The general principles of diffraction ought to be known to the pupil.

He ought to know what is meant by plane polarised light; to describe the act of polarisation in the language of the undulatory theory.

He ought to know what occurs when a beam of light is transmitted through a crystal of Iceland spar; and to describe the state of the emergent light as regards polarisation.

He ought to be able to describe the effects observed when light is transmitted through two plates of tourmaline cut parallel to the axis of the crystal.

He ought to be able to describe some form of the polariscope, and to state and explain by the principles of interference what occurs when a thin plate of selenite is placed between the polariser and analyser.

Heat.

The candidate in the second course must be intimately acquainted with all the subjects introduced into the first.

He ought to be able to give a clear statement of the *mechanical theory* of heat as distinguished from the *material theory*.

He must know what is meant by the "mechanical equivalent of heat," and how it has been determined.

He must know what is meant by specific heat at constant volume and at constant pressure, and to have in his memory the numerical ratio of the two specific heats.

He ought to be able not only to explain the meaning of the difference between the two specific heats in accordance with the mechanical theory, but also to show how from this ratio the mechanical equivalent of heat may be determined.

Given the weight and velocity of a moving body he ought to be able to calculate the amount of heat generated by the stoppage of the motion.

He ought to be able to apply the conceptions of the mechanical theory to the phenomena of combustion.

He ought also to be able to show the bearing of the theory upon the phenomena of specific and latent heat.

Examination for Honours.

The candidate for honours must be intimately acquainted with the foregoing two courses. He must also show himself practically acquainted with the apparatus employed in acoustics, light, and heat.

Text Books.

The Elements of Natural Philosophy, by C. Brooke and Golding Bird, 12mo., 12*s.* 6*d.* (London, Churchill, 6th ed., 1867.)

Ganot's experimental and Applied Physics, translated by E. Atkinson, 8vo., 15*s.* (London, Longman, 2nd ed., 1867.)

Handbook of Natural Philosophy, by D. Lardner. 4 vols., 12mo., 20*s.* (London, Walton, 1856.)

Elementary Treatise on Heat, by Balfour Stewart, 12mo., 7*s.* 6*d.* (London, Macmillan, 1866.)

Heat a Mode of Motion, by J. Tyndall, 8vo., 10*s.* 6*d.* (London, Longman, 3rd ed., 1868.)

A Course of Eight Lectures on Sound, by J. Tyndall, 8vo., 9*s.* (London, Longman, 1867.)

Familiar Lectures on Scientific Subjects, by Sir J. Herschel.

Notes of a Course of Lectures on Light, by J. Tyndall, 1*s.* in printed wrapper; 1*s.* 6*d.* in cloth. (London, Longman.)

SUBJECT IX.—MAGNETISM AND ELECTRICITY.

First Stage or Elementary Course.

Magnetism.

It is exceedingly desirable that the pupil's ideas of the fundamental facts and principles of magnetism should be as clear as our knowledge and his capacity can make them.

He ought to be made acquainted with the action of the natural magnet or loadstone on small pieces of iron. This is to be mentioned to him as the first fact observed, but for the explanation of which other facts are necessary. The action of two natural magnets upon each other ought to be described, and through this action a clear notion of the doctrine of *magnetic polarity* ought to be conveyed to the pupil's mind.

The power of the natural magnet to confer its own magnetic properties upon steel, and the action of the natural magnet on the steel which it has magnetised, ought to be explained.

The action of two pieces of magnetised steel upon each other ought to be made clear, and from this action the fundamental law that like poles repel each other, and that unlike poles attract each other, ougnt to be deduced.

The distribution of magnetism in a bar magnet ought to be made clear. The effect of breaking the magnet into two halves; the effect of again breaking these halves; and through facts of this nature, a clear idea is to be conveyed that each molecule of the magnet is itself a magnet; the action of the magnet as a whole being the sum of the actions of its molecules.

It is of exceeding importance that the pupil should be taught to connect the facts of magnetism by means of the provisional conception known as *the theory of magnetic fluids*. The teacher will assure himself that a correct image of this theory is in the pupil's mind. He will at the same time be careful to inform the pupil that the theory is an image merely, which enables him to connect and classify his facts, and that it is not a proved scientific truth.

The theory is to be applied in explaining the difference between iron and steel as regards their power of accepting and retaining magnetism. The term *coercive force* and all that relates to it will here come under review.

The theory is also to be applied in explaining the first observed facts of magnetism, including in them, and illustrating by them the general phenomena of magnetic induction, or magnetisation by influence. Every student ought to have a clear image of the state of a piece of iron acted on by a magnet, and he ought to be able to explain why the attraction of the iron is a consequence of that state. He ought clearly to see that repulsion as well as attraction is at work, the resultant attraction being the difference of both.

He ought to understand that when the attracting magnet is very distant, the difference between attraction and repulsion is so small as to be imperceptible; this knowledge will render it easy for him to comprehend why the magnetic poles of the earth which give *direction* to a magnetic needle are incompetent to produce a motion of translation.

The pupil ought to know the facts of terrestrial magnetism; why it is that we consider the earth a magnet. It will be possible to make him acquainted with all that is known regarding the position of the earth's magnetic equator and of the terrestrial magnetic poles.

The terms declination (variation), inclination (dip), and magnetic intensity, ought to be explained to him.

Frictional Electricity.

Here also care must be taken to imprint the fundamental facts and principles clearly and firmly upon the pupil's mind. It is easy in the case of frictional electricity to let the pupil actually see some of the facts; and it is exceedingly desirable that he should do so. The same remark applies to the elementary facts of magnetism.

As in the case of magnetism, the fact first observed, namely, the attraction of light bodies by rubbed amber, must be shown to need other facts for its explanation.

The mode of exciting bodies by friction is to be described; the action of rubbed and unrubbed vitreous bodies upon each other; the action of rubbed and unrubbed resinous bodies upon each other; and the action of vitreous bodies upon resinous bodies, and the reverse, are to be clearly described and illustrated. From these facts the law is to be deduced that bodies similarly electrified repel, and dissimilarly electrified attract, each other. The pupil ought to know why the terms vitreous and resinous, as applied to electricity, have been abandoned.

Having been made acquainted with the elementary facts and principles, the pupil is to be rendered familiar with the provisional conception called the theory of electric fluids. As in the case of magnetism, he is to understand that this theory is an image merely, and not a truth.

He ought to be made acquainted, by experiments performed or described, with the qualities of insulation and conduction. He ought to know the reason of the old division of bodies into electrics and non-electrics, and also the unsound character of this classification.

Clear definitions ought to be given as to what is to be understood by positive and what by negative electricity. The pupil must be able to determine the quality of the electricity with which any body is charged.

He must be thoroughly versed in the phenomena of electric induction, and must be able to apply the theory of electric fluids in the explanation of these phenomena. In connexion with the subject of electricity this is the most important part of the teacher's duty, for upon a knowledge of the facts and principles of electric induction the comprehension of almost all that follows it depends.

The pupil ought to be able to construct, or describe the construction, of an electrophorus, and to explain its action by reference to the principles of electric induction.

He ought to be able to explain the condenser by reference to the same principles.

He ought to be able to explain the charging and discharging of the Leyden jar by reference to the same principles.

He ought to be able to describe the charging of the prime conductor of an electric machine by reference to the same principles.

The knowledge implied in the last three questions embraces that of the construction of the condenser, the Leyden jar, and the electric machine. The first form of the Leyden jar ought to be known to the pupil.

The distribution of electricity on the surfaces of conductors is to be made known, and from it the power of points to disperse electricity ought to be deduced. The pupil ought to realise that in virtue of its self-repelling character an electric fluid always moves to the external surfaces of bodies. The power of flames in dispersing electricity ought also to be made known to the pupil.

He will now be ready to understand the form and theory of lightning conductors.

The physiological, deflagrating, and mechanical effects of the electric discharge ought to be known to the pupil. He ought also to be able to apply his knowledge to the explanation of thunder and lightning, and of the return shock.

Voltaic Electricity.

The simplest combinations for the generation of a voltaic current ought to be made known to the pupil. The electric state of the free ends of the two metals immersed in the exciting liquid ought to be described; he ought to be taught to apply the theory of electric fluids to the conception of two currents flowing in opposite directions, and then the omission of one of these currents as a matter of convenience ought to be made known.

It is very important that the pupil should have a clear physical image of the fundamental phenomena before his mind. As in cases formerly referred to, the teacher will be careful to explain that this idea of a fluid flowing in a current is an image merely, and not a proved truth.

Galvani's experiment with the legs of the frog which he suspended by a copper hook on an iron railing ought to be explained; and also the experiment of Sulzer, where the tongue is placed between two metals.

The bearing of the experiment illustrating "the return shock" on Galvani's first observation ought to be explained.

The idea of an electro-motive force separating the two electricities and driving them in opposite directions ought to be distinct in the pupil's mind.

He ought to be made acquainted with the magnetical effects of the circuit, with the action of a current upon iron filings, with its action upon a freely suspended magnetic needle. In this latter action he is to be particularly well versed, so as to be able immediately from the deflection of the needle to infer the direction of the current, and from the direction of the current the deflection of the needle.

He must know the action of a current upon a bar of iron placed within a coil round which a current circulates. He must understand the magnetic properties both of the coil and of the bar.

He ought to be made acquainted with the simplest form of the multiplying galvanometer.

He ought to understand the principles of the needle telegraph.

Some of the chemical effects of the current ought to be made known to the pupil. He ought, for example, to have a distinct notion of the composition of water, and an equally distinct notion of its decomposition by the electric current.

SECOND STAGE OR ADVANCED COURSE.

Magnetism.

The more advanced pupils that undertake the second course ought to be intimately acquainted with all the subjects introduced into the first. The following additional subjects are to be mastered.

The disposition of the so-called magnetic curves round a bar magnet, round two bar magnets with similar or unlike poles adjacent to each other, and round a horse-shoe magnet, must be clearly understood. The pupil must know how a short magnetic needle, or of a short bar of iron freely suspended acts in relation to those lines, and he must be able to show that the lines are deducible from the doctrine of magnetic polarity combined with elementary mechanical conceptions.

He must be able to figure mentally the magnetic curves of the earth, and to see their relation to the line of dip.

He must have perfectly clear notions as to what is meant by the strength of a magnet. He must be able to compare the strength of magnets together, by the method of oscillation, by the torsion balance, or by the deflection of a small magnetic needle.

A knowledge of the principles and use of the torsion balance is quite essential.

He must know what is meant by the law of inverse squares, and be able to show how it has been experimentally demonstrated.

The pupil must be acquainted with the effect of temperature and of percussion upon a magnet.

He must know the meaning of the terms horizontal intensity, vertical intensity, and total force. He ought also to know what is meant by the variation of all of those, that they are different at different parts of the earth's surface, at different hours of the day, at different seasons of the year. To a knowledge of the diurnal and annual variations, he ought to add a knowledge of the secular variation.

Frictional Electricity.

The more advanced pupil must be intimately acquainted with all the subjects introduced into the first course.

He must understand the cascade arrangement of the Leyden battery, as contrasted with the ordinary arrangement.

He must understand the application of the torsion balance to the measurement of electric force.

He ought to be able to think out and describe various new and simple forms of the condenser and the Leyden jar.

He ought to be able to carry forward the idea of an electric fluid to the conception of a current of such fluid; he ought to be able to describe the chemical and magnetical effects of such a current. He ought to be able clearly to contrast those actions as manifested by frictional electricity with the same actions as manifested by voltaic electricity.

He ought to be able to describe the experimental arrangements necessary to the production of primary, secondary, tertiary, and currents of higher order by the discharge of the electric battery.

He must understand the law of inverse squares as applied to electricity, and clearly comprehend its limitations.

The diurnal variation of atmospheric electricity ought to be known to the pupil.

The application of the unit jar in the measurement of electric charges ought to be known to the pupil.

The terms quantity and intensity (or as it is called by some *density*) as applied to electricity ought to be clearly understood. The relation of the heating power of an electric discharge to its quantity and intensity ought also to be known to the pupil.

Voltaic Electricity.

The more advanced pupil must be intimately acquainted with the subjects mentioned in the first course.

To the electro-magnetical knowledge there demanded he is to add the knowledge of determining the strength of a current by the deflection of a magnetic needle.

He ought also to be able to determine the relative strength of two currents by their chemical action.

He ought to know how the magnetism of a bar of iron augments in intensity as the currents which surround it augments in strength.

He ought to know how the *attraction* of iron by an electro-magnet augments as the exciting current is augmented. In this case he ought to see and be able to describe the difference between a piece of soft iron and a piece of exceedingly hard magnetized steel.

He ought to be acquainted with induced currents, their various modes of generation, and their laws of action.

He ought to be able to explain the ordinary madical magneto-electric coil. He ought also to be able to describe Ruhmkorff's coil, and some of the effects obtainable by it.

He ought to be able to sketch a current reverser.

He ought to understand the principles of the astatic needle.

He ought to be able to describe the phenomena of the extra-current.

He ought to be made acquainted with the mutual action of currents upon each other, with the attractions and repulsions which are dependent upon direction.

He ought to know how a coil of copper wire may be suspended so that when a current flows through the wire it shall, like a magnetic needle, obey the directive action of the earth.

He ought to be acquainted with the principles of electro-plating, adding to a knowledge of the decomposition of water a knowledge of other decompositions, by which conducting surfaces may be coated with copper, silver, or gold.

He ought also to be made acquainted with the chemical actions that occur within a voltaic cell when the current circulates.

The arrangement of cells into batteries ought to be described. The pupil ought to be made acquainted with the *pile* of Volta and the *crown of cups*. He ought also to have explained to him the battery of Grove.

The reason for employing two fluids in the cells of this battery ought to be explained.

The dependence of the heat generated on the resistance overcome by the current ought to be made known. He ought to be taught to form as definite a conception as possible of resistance in relation to electromotive force, and to understand the formula which expresses the relation of heat, resistance, and current strength.

He ought to understand the theory of molecular currents, and to be able to apply this theory in explanation of the phenomena of magnetism.

EXAMINATION FOR HONOURS.

Magnetism.

A candidate who enters the honours examination must be intimately acquainted with the foregoing two courses in magnetism. In addition to this he must be able to show that he has a competent practical knowledge of the apparatus employed. He must show ability in devising and executing experiments, and ought to be able in the presence of the examiner to perform experiments illustrative of any or all of the subjects introduced in the foregoing two courses.

Frictional Electricity.

The candidate ought also to know the facts and principles of diamagnetism. He ought also to be able to describe and explain the deportment of crystalline bodies between the poles of a magnet.

In frictional electricity, besides an intimate acquaintance with both of the foregoing courses, the candidate must possess a competent practical knowledge of the apparatus employed. He must be able to devise and execute experiments in the examiner's presence. He must be intimately acquainted with the experiments with a rotating mirror by which Wheatstone determined the velocity of electricity and the duration of the electric spark.

Voltaic Electricity.

Besides being intimately acquainted with the two foregoing courses, the candidate must have a practical acquaintance with the apparatus employed in voltaic electricity.

He must be intimately acquainted with the laws of Ohm which express the relation of electro-motive force, internal and external resistance, and current strength.

He must be able to apply the principles of the dynamical theory of heat to the heat phenomena of the voltaic current. He must be clearly informed as to the manner in which the heat is distributed within and without the battery.

TEXT BOOKS.

As a text book, in addition to the works on Physics and Natural Philosophy mentioned in the Syllabus of Subject VIII., the following work on Electricity may be used:—

Electricity, by R. M. Ferguson, 12mo., 3*s*. 6*d*.
(Edinburgh, Chambers, 1866.)

Notes of a Course of Seven Lectures on Electrical Phenomena and Theories, by John Tyndall, LL.D., F.R.S., 1*s*. in printed wrapper; 1*s*. 6*d*. in cloth. (London, Longman.)

SUBJECT X.—INORGANIC CHEMISTRY.

FIRST STAGE OR ELEMENTARY COURSE.

Pupils presenting themselves for examination will be expected to possess a knowledge of the following subjects:—

Definition of chemistry. Simple and compound matter. Different modes of chemical action. Combining weights. Volume weights.

Principles of chemical nomenclature. Symbolic notation. Graphic notation. Chemical formulæ. Chemical equations. Atomicity of elements. Simple and compound radicals. Definition of a compound radical. Classification of all elements into metals and non-metals, into positive and negative elements. Classification according to atomicity.

French and English systems of weights and measures. Conversion of English into French weights and measures. The crith and its uses.

Hydrogen.—Its preparation and properties.

Chlorine.—Preparation of chlorine from hydrochloric acid. Analysis and synthesis of hydrochloric acid. Properties and reactions of hydrochloric acid.

Oxygen.—Its preparation and properties. Allotropic oxygen or ozone. Formation and reactions of water. Preparation and properties of hydroxyl. Compounds of chlorine with oxygen and hydroxyl.

Boron.—How it occurs in nature. Its allotropic modifications. Boric anhydride. Boric acids.

Carbon.—Its preparation and allotropic forms. Preparation and properties of carbonic oxide and carbonic anhydride.

Nitrogen.—Its preparation and properties. Compounds of nitrogen with oxygen and hydroxyl. Compound of nitrogen with hydrogen. Ammonia. Ammonic salts.

Sulphur.—Its properties and allotropic modifications. Compounds of sulphur with positive elements. Compounds of sulphur with oxygen and hydroxyl.

According to § XXXIX. of the Directory special extra payments are made on account of students who show a good knowledge of experimental chemistry or laboratory practice. This knowledge will at present be tested by questions set with the ordinary examination paper in May. In the elementary stage the course of laboratory instruction to which the questions will be confined will be the preparation of the elements and compounds above enumerated, and the methods of experimentally demonstrating their properties. These questions will, as much as possible, be so framed as to prevent answers being given by pupils who have obtained their information merely from books and oral instruction.

Second Stage or Advanced Course.

In addition to the above subjects, pupils presenting themselves for the advanced examination will be assumed to have received instruction in the following:—

Theory of atoms and molecules. Empirical, rational, and constitutional formulæ. Absolute, latent, and active atomicity. Atomic and molecular combination.

Expansion of gases by heat. Reduction of gaseous volumes to standard pressure and temperature.

Manufacture of hydrochloric, nitric and sulphuric acids. Composition and manufacture of bleaching powder. Theory of bleaching. Suitability of water for domestic purposes. Causes of permanent and temporary hardness in water.

Bromine.—Hydrobromic and bromic acid.

Iodine.—Hydriodic, iodic, and periodic acid.

Fluorine.—Hydrofluoric acid.

Silicon.—Silica. Silicic acid. Silicic hydride. Names and formulæ of some of the more important silicious minerals.

Phosphorus.—Phosphoretted hydrogen. Acids and anhydrides of phosphorus.

Arsenic.—Arsenious and arsenic acids. Arseniuretted hydrogen. Detection of arsenic.

Antimony and Bismuth.—Preparation and properties of their chief compounds.

The monad metals, especially potassium, sodium, and silver. Manufacture of soda-ash.

The dyad metals. Barium, strontium, calcium, magnesium, zinc, cadmium, mercury, and copper.

The chief properties of the following metals:—Gold, aluminium, platinum, lead, chromium, manganese, iron, cobalt, and nickel.

Composition, preparation and properties of the more important compounds of these metals.

The knowledge of experimental chemistry required to obtain the special payments under § XXXIX. of the Directory will in this stage also be tested by questions set with the ordinary examination paper. In this stage the course of laboratory practice and analysis in which questions may be set will include, besides the preceding, the reactions of the principal mineral acids and bases, and the methods pursued in the application of these reactions to the analysis of substances containing one or more of the following constituents:—Potassium, sodium, ammonium, magnesium, calcium, strontium, barium, aluminium, chromium, zinc, manganese, iron, cobalt, nickel, arsenic, antimony, tin, cadmium, copper, bismuth, mercury, lead, silver, hydrosulphuric acid, hydrochloric acid, hydriodic acid, nitric acid, chloric acid, boric acid, carbonic acid, hydrofluoric acid, phosphoric acid, silicic acid, and sulphuric acid.

No candidate will obtain a first class in the advanced stage unless his answers show him to have a fair knowledge of qualitative analysis.

Examination for Honours.

In addition to the above, candidates are expected to possess a knowledge of the following subjects:—

Theory of normal, acid, and basic salts. Constitutional formulæ of the various acids of phosphorus and other elements. Monatomic and polyatomic molecules.

The phenomena of combustion.—Thermal units. Absolute thermal effect, or total amount of heat evolved by various kinds of fuel and other combustibles. Pyrometric thermal effect, or intensity of heat evolved by combustibles. Translation of absolute thermal effect into its mechanical equivalent. Theory of flame. Source of light in luminous flames. Spectrum analysis, its principles and applications. Relations of specific heat to atomic weight.

The law of the diffusion of gases. The laws of electrolysis. The processes used in the quantitative analysis of the more commonly occurring minerals. A knowledge of qualitative and quantitative analysis is essential to the attainment of a class in honours.

Text Books.

The following works may be mentioned:—

Lecture Notes for Chemical Students (Vol. I. Inorganic Chemistry), by E. Frankland, 8vo., 4*s*. (London, Van Voorst, 2nd ed., 1870.)

First Principles of Modern Chemistry, by U. J. Kay-Shuttleworth, 8vo., 4*s*. 6*d*. (London, Churchill, 2nd ed., 1870.)

Introduction to Modern Chemistry, by A. W. Hofmann, 8vo., 4*s*. 6*d*. (London, Walton, 1865.)

First Step in Chemistry, by R. Galloway, 12mo., 6*s*. 6*d*. (London, Churchill, 4th ed., 1868.)

Lessons in Elementary Chemistry, by H. E. Roscoe, 18mo., 4*s*. 6*d*. (London, Macmillan, new ed., 1869.)

For the advanced course the following may be used in addition to the above:—

Chemistry, Inorganic and Organic, by C. L. Bloxam, 8vo., 16*s*. (London, Churchill, 1867.)
Manual of Elementary Chemistry, by G. Fownes, 12mo., 12*s*. 6*d*. (London, Churchill, 10th ed., 1868.)
Elements of Inorganic Chemistry, by W. A. Miller, 8vo., 21*s*. (London, Longman, 3rd ed., 1864.)
Chemistry for Students, by A. W. Williamson, 12mo., 7*s*. 6*d*. (London, Macmillan, new ed. 1868.)
Chemistry for Schools, by C. Haughton Gill, 12mo. (London, Walton, 1869.)
Qualitative Analysis, by R. Galloway, 8vo., 8*s*. 6*d*. (London, Churchill, 5th ed., 1870.)

Besides these works the following are recommended for reading and working for honours:—

Second Step in Chemistry, by R. Galloway, 12mo., 10*s*. (London, Churchill, 1863.)
Chemical Physics, by W. A. Miller, 8vo., 15*s*. (London, Longman, 4th ed., 1867.)
Dictionary of Chemistry, and the Allied Branches, by H. Watts, in four Vols., 8vo., 1st Vol., 31*s*. 6*d*., 2nd Vol., 26*s*., 3rd Vol., 31*s*. 6*d*., 4th Vol., 24*s*. (London, Longman, 1863–66.)
Elementary Treatise on Heat, by Balfour Stewart, 12mo., 7*s*. 6*d*. (London, Macmillan, 1866.)
Heat considered as a Mode of Motion, by J. Tyndall, 8vo., 12*s*. 6*d*. (London, Longman, 2nd ed., 1866.)
Quantitative Analysis, Fresenius, translated by A. Vacher. (London, Churchill, 5th ed., 1870.)

List of Books of Reference for General Library:—

Fresenius's Qualitative Analysis, translated by A. Vacher. 7th edition. 8vo., 9*s*. Churchill and Sons.
Ure's Dictionary of Arts, Manufactures, &c. 3 vols. 8vo., 4*l*. 14*s*. 6*d*. Longmans.
English Cyclopædia, Arts and Sciences. 8 vols. 8vo., each 12*s*. Bradbury and Evans.
Muspratt's Dictionary of Chemistry. 2 vols. 8vo., 67*s*. Mackenzie.
Brand's Dictionary of Science, &c. 3 vols. 8vo., 63*s*. Longmans.
Chemical Technology, by Richardson and Watts.
All the vols. of the Cavendish Society, especially Gmelin's Chemistry, 17 vols. 8vo.
Royal Society Catalogue of Scientific Papers. 4 vols.
The Journal of the Chemical Society from the commencement to the present time.
The Proceedings of the Royal Society from the commencement to the present time.
The Transactions of the Royal Society from the beginning of the century to the present time.
The Philosophical Magazine from the commencement to the present time.
The Proceedings of the Royal Institution. 5 vols.
Die Jahresbericht der Chemie from 1847 *to the present time.* 20 vols. and index, 2 vols.

SUBJECT XI.—ORGANIC CHEMISTRY.

First Stage or Elementary Course.

Pupils presenting themselves for examination will be expected to possess a knowledge of the following subjects :—

Definition of organic bodies; their ultimate analysis. Calculation of empirical formulæ. Compound organic radicals. Notation of organic compounds. Graphic and symbolic formulæ.

Organic Radicals.—Positive radicals. Preparation and properties of the monad radicals of the methyl series. Monad radicals of the vinyl and phenyl series.

Dyad positive radicals of the ethylene series. Preparation and properties of ethylene.

Negative radicals. Cyanogen. Oxatyl. Oxalic acid, its preparation and properties.

Hydrides of the Organic Radicals.—Methylic hydride or marsh gas. Paraffin. Benzol. Cyanic hydride or hydrocyanic acid. Oxatylic hydride or formic acid.

The Alcohols.—Definition of an alcohol. Methylic alcohol. Ethylic or common alcohol. Phenylic alcohol or carbolic acid.

The Ethers.—Definition. Preparation and properties of ethylic ether.

The Haloid Ethers.—Their constitution. Preparation and properties of ethylic chloride and iodide.

The Aldehydes.—Their nature and properties. Acetic aldehyde. Benzoic aldehyde or oil of bitter almonds.

The Acids.—Definition of an organic acid. Acetic acid. Lactic acid, Benzoic acid.

Ethereal Salts.—Definition and constitution of the ethereal salts of the monobasic acids. Preparation and properties of acetic ether and butyric ether.

The evidence of a good knowledge of chemical manipulation will be rewarded by special extra payments. (*See* § XXXIX. of the Directory.) This knowledge will at present be tested by questions set with the ordinary examination paper in May, and the course of laboratory practice to which the questions will be confined will be the preparation of ethyl, ethylene, cyanogen, oxalic acid, marsh gas, hydrocyanic acid, ethylic alcohol, ethylic ether, ethylic iodide, acetic acid, lactic acid, and ethylic acetate or acetic ether. The analytical detection of hydrocyanic acid, oxalic acid, tartaric acid, citric acid, and acetic acid.

Second Stage or Advanced Course.

In addition to the above subjects, students presenting themselves for this examination will be assumed to be acquainted with the following :—

Determination of the rational formulæ of organic acids and bases. Graphic and symbolic types of organic compounds. Reduction and development of the formulæ of organic bodies. Classification of organic compounds.

Organic Radicals.—Dyad positive radicals of the acetylene series. Single and double cyanides. Manufacture of prussian blue and of oxalic acid.

Hydrides of the Organic Radicals.—Ethylic and amylic hydrides. Hydrides of the radicals of the phenyl series. Manufacture of coal-gas.

The Alcohols.—Classification, preparation and properties of alcohols. 1. Monacid alcohols; methyl series, vinyl series, allyl series, pheny series. 2. Diacid alcohols or glycols; ethylic glycol and its derivatives. 3. Triacid alcohols; glycerin, its preparation and properties.

The Ethers.—1. Ethers of the monacid alcohols;—methylic ether, allylic ether, phenylic ether. 2. Ethers of the diacid alcohols;—ethylenic oxide. 3. Ethers of the triacid alcohols;—glycylic ether.

The Haloid Ethers.—Haloid ethers of the monad, dyad, and triad positive radicals. Methylic chloride. Manufacture of chloroform. Ethylenic bromide.

The Aldehydes.—Formation and re-actions of the aldehydes of the methyl, vinyl, and phenyl series of alcohols.

The Acids.—Law of basicity of organic acids.

Monobasic acids:—Acetic or fatty series. Acrylic or oleic series. Lactic series. Pyruvic series. Glyoxylic series. Benzoic or aromatic series.

Dibasic acids:—Succinic series. Fumaric or acryloid series. Malic or lactoid series. Tartaric or glyoxyloid series.

The Anhydrides.—Definition and constitution of the anhydrides. Formation and re-actions of the anhydrides of monohydric monobasic acids, dihydric monobasic acids, and of dihydric dibasic acids.

The Ketones.—Derivation and constitution of the ketones. Preparation and properties of acetone.

Ethereal Salts.—Ethereal salts of dibasic and tribasic acids, and of monacid, diacid, and triacid alcohols.

Organic Compounds containing Nitrogen, Phosphorus, Arsenic and Antimony.— The more important natural and artificial alkaloids. Extraction of quinine from cinchona bark.

Organometallic Bodies.—Definition. Their behaviour and formation. Preparation and properties of zincic ethide, mercuric ethide and stannic ethide.

The evidence of a good practical knowledge of organic analysis, and of experimental manipulation will be rewarded by special extra payments. (*See* § XXXIX. of the Directory.) This knowledge will be tested by questions set with the ordinary examination paper. In this stage the practical questions may include, besides those enumerated under the first stage, the quantitative analysis of organic bodies containing carbon, hydrogen, oxygen, and nitrogen; and the preparation of acetylene, ethylic hydride, amylic alcohol, phenylic alcohol, ethylic glycol, glycerin, ethylenic oxide, chloroform, benzoic aldehyde, acrylic acid, malic acid, succinic acid, acetic anhydride, acetone, ethylamine, and zincic ethide.

Examination for Honours.

In addition to the above, the candidate should be well acquainted with the following subjects:—

Determination of the specific gravity of gases and vapours. The methods employed in the analysis of gaseous organic bodies. Synthesis of organic compounds. Determination of the constitutional formulæ of organic bodies. Isomerism, metamerism and polymerism in organic bodies.

Organic Radicals.—Normal, secondary, and tertiary monad radicals. Isomerism of ethylene and ethylidene compounds. Relations between methyl, oxatyl and cyanogen.

Hydrides of the Organic Radicals.—Relations of the positive monad radicals to their hydrides.

The Alcohols.—Relations of the normal monacid alcohols to the monad C_nH_{2n+1} radicals, the dyad C_nH_{2n} radicals, and to the hydrides of the $C_n H_{2n+1}$ radicals.

Secondary monacid alcohols. Isopropylic, pseudamylic and pseudohexylic alcohols.

Tertiary monacid alcohols. Pseudobutylic alcohol.

Normal and secondary alcohols of the phenyl series.

Relations of glycerin to isopropylic and allylic alcohol; also to glyceric, tartronic, and acrylic acid.

Other polyacid alcohols:—Erythrite, mannite, glucose.

The Acids.—Difference between hydricity and basicity of acids.

Normal, secondary, and tertiary fatty acids. Relations of the fatty acids to the C_nH_{2n+1} series of radicals, and to the $C_nH_{2n+1}Ho$ series of alcohols. Relations of the fatty acids to each other; ascent of the series.

Normal, secondary, and olefine acids of the acrylic or oleic series. Relations of the acrylic to the acetic series of acids.

Definition and classification of the acids belonging to the lactic series. Relations of the lactic to the fatty and acrylic series of acids. Isomerism in the lactic series.

Relations of the pyruvic series of acids to the oxalic and lactic series.

Relations of the glyoxylic series of acids to the glycerin series of alcohols.

Constitution and classification of the dibasic acids. Relations of the succinic series of acids to the lactic and acetic series, and to the glycols.

Isomerism in the fumaric series of dibasic acids.

Tartaric or glyoxyloid series of dibasic acids. Varieties of tartaric acid.

Constitution and classification of the tribasic acids.

The Ketones.—Isomerism in the ketone family.

Organic Compounds containing Nitrogen, Phosphorus, Arsenic, and Antimony.—The amines, phosphines, arsines, and stibines. Primary, secondary, and tertiary organic bases. Monamines, diamines, triamines, and tetramines.

Organometallic Bodies.—Their constitution and its bearing upon the doctrines of atomicity.

Text Books.

In addition to such of the works as treat on Organic Chemistry recommended in the Syllabus of Subject X., the student's attention is drawn to the following:—

Elements of Organic Chemistry, by W. A. Miller, 8vo., 24*s.* (London, Longman, 3rd ed., 1866.)

Lecture Notes for Chemical Students (Vol. II. Organic Chemistry), by E. Frankland, 8vo. (London, Van Voorst, 2nd. ed., nearly ready.)

SUBJECT XII.—GEOLOGY.

First Stage or Elementary Course.

A.—Preliminary Subjects.

a. Basis of Geology.—Definition of the objects of geology. Waste of land now going on by mechanical causes,—rain, running water, frost, snow, glaciers, and by the sea. Origin of rounded pebbles, grains of sand, and mud. Sediments carried in mechanical suspension in rivers. Deposition of strata now forming in the sea and in lakes from sediments formed mechanically. Other strata formed in part or entirely of organic remains, and how they are preserved. Proof that stratified rocks generally were formed by deposition from water, as above, and that strata have been successively deposited and are of ages less or more apart Definition of the term igneous as applied to rocks.

b. Common Geological terms.—Definition of "crust of the earth," clay, sand, gravel, shale, sandstone, conglomerate, breccia, limestone, lava,

volcanic ashes, stratum or bed, *a formation*, group of formations. Recent, Cainozoic (tertiary), Mesozoic (secondary), and Palæozoic formations. Horizontal, inclined, vertical strata. Anticlinal and synclinal curves. Contorted strata, dip, strike, outcrop, a basin. Conformable and unconformable stratification, joint, slaty cleavage, fault, lode, vein. Names of some of the metamorphic rocks.

c. Composition of principal rocks and their common minerals.—Minerals that form granites and granitic rocks; Syenites, Diorites (greenstones), Basalts, Dolerite, gneissic rocks, limestones. Coal, what originally formed from. Colouring matter of rocks.

d. Disintegration and Solutions.—Disintegration, and solutions of minerals composing rocks by means of acids; mineral springs, and substances in chemical solution in rivers, lakes, and the sea. How produced.

e. Snow and Ice.—How glaciers are formed from snow. Movement of glaciers and transport of matter on their surfaces. Moraines. Erosion of rocks, over which glaciers flow. Icebergs, whence derived. Transport of matter from cold to warmer latitudes by icebergs.

f. Rivers.—Cutting out of terraces *and valleys* by rivers. Transport of material seaward, and gradual growth of Deltas.

g. Marine Denudation, Transport and Consolidation of Material and Fossilization.—Waste of sea coasts by breakers and by help of landslips. Rounding of pebbles and grains of sand on shores and in streams. The effect of long continued marine denudation on the land; formation of bays and head-lands, &c. Distribution of sediments derived from land over sea bottoms, forming modern marine strata. Consolidation of strata by pressure, chemical changes and heat. Preservation of shells, &c., in seas, lakes, and delta deposits, in alluvium, and in and under peat, blown sand, and volcanic ashes.

h. Central Heat, Volcanos, Earthquakes, and other Movements of the Earth's Crust.—The connexion of the corals reefs of the Pacific Ocean with the gradual sinking of the sea bottom. Fringing reefs, barrier reefs, atolls. Volcanos and their connexion with some areas of upheaval of land above the sea. Raised beaches and sea bottoms. The structure of volcanos. The wave-like motion of earthquakes. General structure of mountain chains. The existence of so-called central heat in the earth. Change of common strata, such as shale and slate, sandstone, limestone, &c., into mica-schist, gneiss, quartz rock, crystalline limestone, &c. (metamorphism).

B.—Classification of Animal and Vegetable Life.

i. A rudimentary acquaintance with the meaning of the names of those CLASSES of animals and plants that are or may be found fossil, such as Mammalia, Aves (birds), Reptilia, Pisces (fish), Insecta, Myriapoda (centipeds, &c.), Arachnida (spiders, &c.), Crustacea (crabs, &c.), Annelida (worms, &c.), Echinodermata (sea-urchins, starfish, &c.), Cephalopoda (cuttle-fishes, &c.), Pteropoda, Pulmonata (land snails, &c.), Gasteropoda (periwinkles, limpets, &c.), Conchifera (oysters, cockles, &c.), Brachiopoda (terebratula, &c.), corals, sponges. The Vegetable Kingdom: the names of the classes and orders of plants.

Succession of Strata, Igneous Rocks, &c.

C.—Palæozoic Series.

k. Oldest known stata or the Laurentian rocks. Their metamorphic character. Oldest known fossil. Huronian rocks of Canada.

l. Cambrian and Silurian strata.—Cambrian rocks, and their traces of fossils. Lingula flags and Tremadoc slates. Llandeilo and Bala beds, and the lavas and volcanic ashes associated with them. Llan-

dovery or Pentamerus beds. Upper Silurian series. Leading kinds of fossils common in these formations, such as the genera of Graptolites, Corals, Brachiopoda, Conchifera, Cephalopoda (chambered shells), Echinodermata, Crustacea (especially the Trilobites), and first appearance of fish remains and land plants.

m. Old Red Sandstone and Devonian strata.—The areas in Britain that formed land before the deposition of the Old Red Sandstone. Unconformities of Old Red Sandstone on older rocks. Division into lower and upper Old Red Sandstone and unconformity. The nature of the rocks. The fish found in the lower, and the fish, fresh-water shells and plants in the upper Old Red Sandstone. *Devonian strata.*—Commonly divided into lower, middle, and upper. Their marine fauna, corals, shells bivalve and univalve, Goniatites and other cephalopoda, Trilobites, &c. Difference between the Silurian and Devonian genera and species.

n. Carboniferous strata.—The ordinary succession of these strata in Wales and the South of England (See also parts of 16 in Advanced Stage). The kinds of corals, shells, and fish found in the Carboniferous Limestone, and other beds. The kind of sections found in the *Coal-measures.* The Underclay generally below beds of coal. How coal was formed from fossilized plants. How there came to be many beds of coal in one coal-field with beds of shale, ironstone, and sandstone between.

o. Permian formations.—Their succession in England and Germany, and the proofs of their unconformity on the Carboniferous strata. The structure of the Rothliegende or Brecciated Conglomerates, the Marl-slate or Kupferschiefer, the Magnesian limestone (Zechstein). Their fossils.

D.—Mesozoic or Secondary Series.

Lower Mesozoic.

p. New Red Sandstone or Trias.—British divisions: 1st. New Red Sandstone (Bunter); 2nd. New Red Marle (Keuper). Continental divisions. New Red Sandstone, Muschelkalk, New Red Marle. Unconformity on Permian and older rocks. Great changes of life in passing from Palæozoic to Mesozoic times. Change in the relative numbers of Brachiopoda and Conchifera when compared with Palæozoic rocks, and continuation of this down to present day. New Cephalopoda, encrinites, fish, and reptiles. First known mammal. Plants of the Keuper sandstone, crustacea, reptiles, &c. Origin of rock-salt by evaporation. Gypsum of red marle. Parts of what is now the British Islands that formed land before the deposition of the Trias.

q. Rhætic or Penarth beds.—(See 19, p. 7.)

r. Lias formations and Oolites.—(Jurassic of the continent). Division into Lower, Middle, and Upper Lias, and Lower, Middle, and Upper Oolites. The names of the formations included in each of these. Characters of the rocks. Great development of life of these periods. Leading marine fossils of the Lias and land plants and insects. Common genera of Brachiopoda and Conchifera, Gasteropoda, Cephalopoda, Echinodermata, Fish, and Reptiles. Leading fossils of the Oolites as above, and also Mammalia. Proofs of land in the neighbourhood of the British Liassic, and Oolitic seas.

s. Purbeck and Wealden strata.—Their estuarine character, and proofs of this from the fossils. Generic names of leading fossils. Proofs of the existence of a neighbouring large continent.

Upper Mesozoic.

t. Cretaceous series.—British divisions, Lower and Upper and their subdivisions. The nature of the strata and general grouping of fossils (as in *r* above). Differences when compared with Oolitic genera and species.

Uppermost Cretaceous beds absent in Britain, viz. the Maestricht and Faroe beds and the beds of Aix-la-Chapelle. Account of these.

E.—Cainozoic or Tertiary Series.

u. Eocene or Lower Tertiary.—Meaning of the terms Eocene, Miocene, and Pliocene. Areas occupied by the English and French Eocene strata, and divisions of the English Eocene strata. Their fossils, freshwater, estuarine, and marine. Proofs of neighbouring land in freshwater shells, plants, and terrestrial mammalia.

v. Miocene or Middle Tertiary, of Bovey-Tracey, Mull, &c. French marine strata and freshwater and volcanic formations. The kinds of fossils they contain. The Swiss, Italian, and other continental beds. The floras of the period, insects, mammalia, reptiles, shells, &c. The Arctic Miocene beds, and flora. Indian Miocene strata and their fossils.

w. Post-Pliocene strata, Crag, &c.—Divisions of the British Crag, characters, and fossils, marine and terrestrial. Economic products. Crag of Belgium. Proportions of recent species in the different members of the Crag. Sub-Appenine strata and those of Sicily.

x. Glacial period and other strata later than the Crag.—The Forest beds beneath the boulder clay, and the union of Britain with the continent, and its Flora, terrestrial Fauna, and shells. (See also 26, p. 9.) The glaciers of the glacial period, before, during, and after the deposition of the marine boulder clays. The origin and nature of the boulder clay. Other proofs of a cold climate, and the marine and terrestrial Fauna of the period.

Second Stage or Advanced Course.

A.—Preliminary Subjects or Principles.

1. All contained in *a* of the elementary stage.
2. All contained in *b*.
3. All contained in *c*, and the chemical constituents of silica, various felspars, micas, augite, diallage, hornblende, garnet, obsidian, pitchstone, pumice. Limestone, Magnesian limestones or Dolomite. Coals, such as common house and furnace coals, cannel coals, and anthracites. Iron ores. The colouring matter of rocks. The general relative proportions in the known crust of the earth of mineral substances, such as silica, alumina, lime, magnesia, iron, &c. &c.
4. *Chemical disintegration.*—Chemical disintegration of rocks on a large scale; formation of kaolin, fireclays and other clays and shales. Origin of mineral springs, and substances in solution in rivers, seas, and other waters. Skeletons of shell fish and other marine and fresh water animals, whence derived, and how strata are formed of these.
5. *Effects of snow and ice.* — What is a glacier, and how formed. Change of snow into solid ice. Stratification and veined structure of ice. Inclinations of beds and surfaces of glaciers. Why glaciers flow. Rates of progress. Crevasses. Moraines, lateral, medial, terminal, and how they are formed. Erosion of rocks under glaciers and its results. Flow of water from lower ends of glaciers. Destruction of terminal moraines, and circumstances that induce their occasional preservation. Oscillation of size of glaciers. Deepening of valleys. Signs left by glaciers that have disappeared. Icebergs of Arctic and Antarctic regions and of South America; how formed. Ocean currents. Transport of matter by icebergs, and its distribution over existing sea bottoms. Transport of detritus by coast ice and river ice.
6. *Landslips.*—Landslips in mountainous and hilly regions, and landslips on sea coasts. Their effect in bringing matter within the influence of running water and of the sea.
7. *Rivers.* — Erosive and transporting power of brooks and rivers.

Their influence in forming gorges and valleys. Origin of waterfalls. Amount of matter carried seaward by great rivers such as the Nile, the Ganges, the Mississippi, &c. The mode of formation and gradual growth of deltas and their possible age. Filling up of lakes by sediments. General effects on the form of the ground and lowering of level of continental and smaller areas by combined effects of chemical disintegration, rain, rivers, frost, snow, and glacier ice.

8. *Marine denudation.*—Waste of sea coasts by breakers and landslips. Formation of pebbles and sand on sea coasts. Amount and nature of waste of boulder clays of eastern coasts of England, &c.; of Tertiary strata, and of Cretaceous and Oolitic strata on east and south coasts. Waste of harder rocks of west of England, Wales, and Scotland. Power of breakers in moving sand and shingle, and large blocks of stone. Effect of prevalent winds on waste and transport of material along shores. Silting up of estuaries. Effect of groins and other artificial obstructions on coasts. Warping of alluvial tidal flats. Forms of sea cliffs and origin of many bays and headlands. Origin of great plains of marine denudation by combined action of breakers, landslips, and general lowering by waste of the interior of countries. Subsequent upheaval of such plains and renewed scooping out of valleys. Origin of certain tablelands and their valleys.

9. *Distribution of Material in Sea, &c. forming Modern Strata.*—Transport of matter by great marine currents, passing mouths of rivers and along coasts. Transporting powers of tidal currents. Sifting action of the sea in arranging sediments along its bottom. Icebergs (see 5). Modern formation by above causes of beds of clay, sand, gravel, and boulder beds, and mixtures of these. Volcanic ashes falling in sea and lakes. General formation of lacustrine strata. Formation of beds of limestone by organic bodies in seas, lakes, and lagoons. Coral reefs (see 10). Salts carried in solution in rivers into lakes, evaporation of surplus water, concentration and precipitation. Origin of rock salt, &c.

10. *Fossilization and Consolidation of Strata.*—Shells and other marine organic remains buried in sediments. Also terrestrial plants. Worm burrows. Terrestrial animals. Organic remains in lakes and river deltas, in alluvial beds and brickearths; in and under peat, under blown sand, and in volcanic ashes and under lavas. Formation of sediments by foraminiferæ, &c. in deep seas. Consolidation of strata by pressure, infiltrations, and precipitations, chemical decomposition and recomposition and heat.

11. *Central Heat, Volcanos, Earthquakes, and other Movements of the Earth's Crust.*—Theory of Coral Reefs. Fringing reefs, Barrier reefs, Atolls, and proofs of gradual subsidence of the sea bottom. Connexion of coral reefs with the volcanic islands of the Pacific Ocean and areas of partial upheaval. Upheaval of the west coast of South America. Oscillations of level on the coast of the Baltic, Greenland, &c. Raised beaches and sea bottoms.

Theories of central heat how inferred. Radiation of heat from the earth, consolidation and theory of the formation and shrinkage of its crust. External phenomena of volcanos, and theories of volcanic action. Earthquakes. Mallet's theory, and oscillations of level accompanying earthquakes.

Metamorphism of rocks. Theory of slaty cleavage, passage of shales clayslate, sandstone, limestone, and their intermediate gradations into mica-schist, chlorite-schist, various kinds of gneissic rocks, quartz-rock, crystalline limestones, &c. Special development of distinct minerals in rocky masses. Relation of the above to gradual subsidence of rock masses and accumulation of strata above them. Origin of mountain chains. Disturbance and contortion of strata in successive stages, and probable causes of these phenomena.

B.—Classification of Animal and Vegetable Life.

12. All contained in *i* of the Elementary stage, p. 2, together with a general knowledge of the orders of Mammalia, Birds, Reptiles, Amphibia, Fish, Insects, &c., Crustacea, Echinodermata, Cephalopoda, Pteropoda, Pulmonata, Gasteropoda, Conchifera, Brachiopoda, Polyzoa, Corals, &c., and the classes and orders of the vegetable kingdom.

Succession of Strata, Igneous Rocks, &c.

C.—Palæozoic Series.

13. *Laurentian rocks* of Scotland, and Lower and Upper Laurentian rocks of Canada, &c. Huronian rocks of Canada. Their metamorphic character and peculiarities of structure. Eozoon Canadense, its nature, structure, and mode of growth. Ages of their metamorphism, and the inferences to be drawn from this.

14. *Cambrian and Silurian strata*. *Cambrian rocks* and their passage into the Lingula flag series. Fossils of the Cambrian rocks; their slaty cleavage and slate quarries.

Lower Silurian.—*Lingula flags*, their lithological character and fossils. *Tremadoc slates*, their lithological character and fossils. Unconformity of the Llandeilo and Bala beds on these, and break in the succession of life. *Llandeilo and Bala beds*, their lithological character and fossils. The igneous rocks, lavas, ashes, &c. associated with these.

Upper Silurian.—*Llandovery* or *Pentamerus beds*, their fossils and unconformity on the Lower Silurian strata, and partial change of species. Remainder of the *Upper Silurian strata* of the Wenlock and Ludlow series, their characters and fossils. First appearance of fish. Remains of plants. Reasonings on the connexion of unconformable stratification with partial or total breaks in the succession of species and genera in time. (This may be applied to all the cases of unconformity subsequently noticed.)

15. *Old Red Sandstone and Devonian strata.*—Passage of Upper Silurian into Lower Old Red Sandstone in Wales and on its borders. Disappearance of the life of the Silurian period. The land that existed in Scandinavia and Britain before the deposition of the Old Red Sandstone, and round and on which the Old Red beds were deposited. Fish of the lower Old Red Sandstone; their distinctive characters.

Upper Old Red Sandstone.—Lithological characters, fish, shells, and plants. Unconformity of the upper on the lower Old Red Sandstone, and approximate or actual passage of the former into the Lower Carboniferous strata. Condition of the waters in which the Old Red Sandstone formations were probably deposited. If partly glacial, and the signs of this?

Devonian strata.—The division of these strata commonly made into Lower, Middle, and Upper Devonian. The marked difference of conditions of deposit shown in the general nature of their fossils, viz., the fish of the Old Red Sandstone, and the Corals, marine bivalve and univalve shells, Cephalopoda and Trilobites of the Devonian strata. The stratigraphical relation of the Devonian strata to the Silurian rocks of Devon and Cornwall, of Germany, and North America. The relation of the so-called Upper Devonian beds to the Carboniferous strata. The appearance of new genera and species in the Devonian rocks. The plants of the North American beds.

16. *Carboniferous strata.* — Succession of Carboniferous strata in Wales, and its borders, and the south of England, viz., Lower limestone shale, Carboniferous limestone, Upper limestone shale, Millstone grit, and Coal-measures. The lithological characters of these and their fossils, marine, freshwater, and terrestrial. The manner in which the beds below the Coal-measures were accumulated. The manner

of the formation of the Coal-measures, the peculiar strata beneath each (or most) beds of coal, the nature of the plants that formed the coal, their mode of growth, and the cause of the succession of beds of coal in thick series of strata. The gradual passage of the Carboniferous strata into a set of beds differently arranged in their stratification, especially in their lower members, proceeding northwards through Lancashire and Yorkshire into Northumberland, and Scotland. The physical causes that produced this difference. Also the absence of certain members of the series in some of the English, and in part of the Scotch coal fields, and the physical phenomena that caused this absence. The Carboniferous series as developed in Ireland. The Carboniferous rocks of the continents of Europe and North America. Their resemblances to those of the British islands; climate, its average uniformity in space and time during this epoch. The surface areas occupied by the European Carboniferous strata now. The areas where they may be concealed under newer formations. The areas where originally formed, viz., which they spread over before reduced to their present limits by denudation. The disturbances of the Carboniferous rocks, and the reasons why coal fields (like parts of many other formations) so often lie in basins. Various kinds of coal, such as the varieties of coal commonly called bituminous, cannel coal, and anthracite. The chemical changes that vegetation underwent in its passage into coal, first on the surface, and afterwards under pressure. The passage of "bituminous" into anthracite coal and the probable reason, and the connexion of this subject with highly disturbed areas. Specialities. Development of crustacea of the Carboniferous rocks as distinguished from those of the Devonian and Silurian periods. Prevalence of certain genera of brachiopoda and conchifera, and relative proportions of these in the Carboniferous rocks when compared with older formations. Fish and reptiles of the Carboniferous rocks. Footprints, rain drops, land shells, and insects, and what they indicate. Ironstones. Mineral veins in Carboniferous limestone series.

17. *Permian formations.*—Succession of these in Britain, Germany, and Russia. 1st. The Rothliegende, its structure, and the evidences of the glacial agencies by which parts of it were deposited. 2nd. The Kuperschiefer of Germany and Marle-slate of England, with mineral contents, fish, &c. 3rd. The Magnesian limestone (Zechstein), its mineral character and composition; its fossils; evidence of their palæozoic character, partial community of species, and numbers and size when compared with the genera and species of the Carboniferous limestone. Cause of this. Unconformity on the Carboniferous and older rocks; submersion of old lands during its deposition; bearing of this on conglomeratic and brecciated structure of the Rothliegende and the general development of the life of the period, including plants and reptiles.

D.—Mesozoic or Secondary Series.

Lower Mesozoic.

18. *Divisions of Trias, or New Red Sandstone series* (see *p*, p. 2).—Unconformity and great break in succession of life in passing from Permian to New Red Sandstone. Great development of Conchifera and decrease of genera of Brachiopoda. The relation of this to lapse of time, as shown by unconformity, and continued prevalence in later times of many of these early Mesozoic types. The generally unfossiliferous character of the New Red Sandstone beds (Bunter), and their minor divisions in England. The absence in England of the Muschelkalk, and its presence on the Continent. Its fossils (see *p*, p. 2). The minor divisions of the New Red Marle (Keuper). Its fossil plants and reptile bones and

footprints. Microlestes. Rain drops. The rock salt of this formation, and how it was deposited. Theory of inland salt lakes or seas of the present day, and the bearing of this and of the above-named marks of rain drops and footprints on the point. New Red Sandstone of the United States, and numerous footprints of reptiles and impressions of bird-like feet. Gypsum. Those parts of the British islands that formed land before and during the New Red Sandstone period.

19. *Rhætic or Penarth Beds.*—Intermediate between New Red Marle and Lower Lias. Gradual passage of nearly unfossiliferous red marles into these more fossiliferous strata. Character and names of some of the common fossils, such as *Avicula contorta, Cardium Rhæticum*, &c. Their affinities with Liassic forms and conformable passage into that formation in Britain.

20. *Lias formations and Oolites.* (Jurassic of the Continent).—Names of the several formations of the Lias and Oolites between the Lower Lias and the Portland Oolite in serial order, and their grouping into Lower, Middle, and Upper Lias and Oolite. Lithological characters of the Liassic formations. Fossils of the different formations. Plants and insects. Corals, brachiopoda, conchifera, gasteropoda, cephalopoda, echinodermata, crustacea, fish, and reptiles. The distinctive characters of some of these, their relative numbers compared with the same classes in the Palæozoic rocks. Nature of the connexion of the Lias with the Inferior Oolite. Lithological characters of the Oolitic formations and their uses. Marine fossils of the different formations of the above-named classes; also mammalia. Evidences of the existence of older land in the neighbourhood of the Liassic and Oolitic seas, and of the climate of the period drawn from plants and animals. Names of the most characteristic genera of Lias and Oolites, especially with reference to their prevalence, such as the names of the prevalent genera of brachiopoda, conchifera, gasteropoda, and cephalopoda, echinodermata, crustacea, fish, and reptiles. Jurassic strata of the Continents of Europe and Asia. The Jura and the Alps, and the fossils of Solenhofen. Disturbance and metamorphism of Jurassic strata. Names of some of the species characteristic of some of the formations, and extent of the community of species. Contrast the life of these epochs with similar developments in Palæozoic epochs.

21. *Purbeck and Wealden strata.*—Their general fresh-water nature and marine interstratifications. Extent of these formations in England and on the Continent. Their characters and thickness. Fossils of the Purbeck strata. Plants, land insects, mammalia, fish, reptiles, univalve and bivalve shells, and crustacea. Fossils of the Wealden formations as above. Evidences of the upheaval of extensive continental land of the period, and the manner in which the Purbeck and Wealden beds were deposited.

Upper Mesozoic.

22. *Cretaceous series.*—Description of the British divisions and subdivisions. Their lithological characters and passage of Weald clay into Lower Cretaceous beds in the Wealden area and Isle of Wight. Fossils of the formations noticed in the same way as those of the Oolitic strata. The Chalk, by what organic bodies chiefly formed. Comparison with similar deposits forming in existing oceans. Nature of flints interstratified with chalk, and vein and tabular flints. Resemblances and differences of the genera and species of the Oolitic and Cretaceous epochs, and the bearings these have on lapse of time between the deposition of the Portland Oolite and the commencement of the Atherfield clay. Continental Cretaceous geology generally. Hippurite limestone. Upper Cretaceous rocks unknown in Britain. Maestricht beds and Chalk of Faxoe in Zeeland, Denmark. Upper Cretaceous beds

and flora of Aix-la-Chapelle. Cretaceous strata of North and South America.

III.—Cainozoic or Tertiary.

23. *Eocene or Lower Tertiary.*—Meaning of the terms Eocene, Miocene, and Pliocene as used by Sir Charles Lyell. Grouping of greater divisions and subdivisions of the English and French strata as usually given in manuals. Areas occupied by the English and French Eocene strata. Evidence of the upheaval of the Chalk and older strata of Western Europe before the Eocene period. Fossils of the Thanet sand and Woolwich and Reading beds, of the London clay, Bagshot, Bracklesham, and Barton beds, and of the Isle of Wight and Hampshire strata from the Headon to the Hempstead beds inclusive; viz., plants, foraminifera, brachiopoda, conchifera, and gasteropoda, marine, estuarine, and fresh-water; cephalopoda, echinodermata, cirripedia, crustacea, fish, reptiles, birds, and mammalia. The evidence shown by these of the manner in which the different formations or parts of formations were deposited; 1st, into three broad divisions, estuarine and fluvio-marine below; marine in the middle; and fresh water, estuarine and fluvio-marine above. Evidences of land and its nature drawn from plants and from mammalian remains. Plants of the various subdivisions, and association of plants in Hempstead series with Eocene shells of lower beds. The nummulitic beds of England, the Continent of Europe, Asia, and Africa. Evidences of climates of Eocene times as indicated by shells, reptiles, and plants, &c. Original extension and subsequent denudation of Eocene beds in Britain. Denudation of the Weald.

24. *Miocene or Middle Tertiary strata.*—British Miocene strata and igneous rocks. Fossils of and nature of the strata. French marine and fresh-water and igneous rocks. Their fossils and the mammalia of the period. Miocene beds of the Rhine, Switzerland, Bohemia, and other parts of the Continent of Europe. Their divisions, lithological characters, and fossils. The Alps and other lands before the Miocene epoch, and the manner in which the Swiss, Italian, and other Miocene rocks were deposited. Theory of a glacial episode during Miocene times. Mammalia. The Miocene insects and flora, especially of the British, Swiss, Icelandic, and Arctic regions. Brown coal of England and the Continent. Disturbances of the Alps and Jura before and after the close of the Miocene epoch. Miocene rocks of India and the United States and their fossils.

25. *Post-Pliocene Strata, Crag, &c.*—(See *w*, p. 3) and in addition proofs of Britain having been joined to the Continent before the Crag epoch.

26. *Glacial period and other Strata later than the Crag.*—Old land surface of Britain later than the Crag and Forest beds. Their plants, mammalia, and shells. The Glacial period. Great glaciers before the deposition of the boulder drift in the northern and southern hemispheres generally, and in Switzerland and other mountain ranges specially. The signs of this. Boulder beds and arctic shells. Minor glaciers during and after the deposition of the boulder beds. Their signs. Erosion of valleys by ancient glaciers. Theory of the formation of rock-bound basins by glaciers and of other lakes by boulder beds and eskers or kaims. General nature of the fauna of the period. Union of the British islands and their union with the continent before and after the glacial epoch. Theories of the causes that produce this glacial period and of glacial periods in general. Volcanic rocks of the Eifel. Loess of the Rhine and other rivers, brick-earths, river-gravels, and alluvia of various ages. Mammalian and other bones in these in Europe, Asia, and America. Bone caves and the manner of the preservation of their fossils. Relics of man and his works in caves, river deposits, shell

mounds of Denmark, &c., and in Swiss and other lakes. Contours of ground before and after the glacial period. Pre-glacial and post-glacial valleys.

27. Theories that have been proposed to explain the distribution of life in individual formations and throughout the whole geological series, or the origin, increase, distribution, and disappearance of species and genera commonly so called. The relations of the life of successive formations to each other generally. Relations of existing faunas and floras of the world to those of Miocene, Pliocence, and Post-pliocene age.

28. Water-bearing strata and underground drainage. Artesian and other wells. Rocks in which ores are found, and mode of occurrence of those in beds, lodes, and superficial detritus. The rules that ought to guide the miner in sinking for coal and other minerals, when the beds in which they lie are concealed by overlying and unconformable strata.

Examination for Honours.

In addition to the foregoing, candidates may be examined in any subjects treated of in standard manuals and other books mentioned below.

Text Books.

The following may be used as text-books :—

Principles of Geology, by Sir C. Lyell, 2 vols., 8vo., 32*s*. (London, Murray, 10th ed., 1868.)

Elements of Geology, by Sir C. Lyell, 8vo., 18*s*. (London, Murray, 6th ed., 1868.)

The Students Manual of Geology, by J. B. Jukes, 8vo., 12*s*. 6*d*. (London, Longman, 2nd ed., 1862.)

The School Manual of Geology, by J. B. Jukes, 12mo., 4*s*. (London, Longman, 1863.)

Introductory Text-book of Geology, by D. Page, 8vo., 2*s*. (Edinburgh, Blackwood, 7th ed., 1867.)

Advanced Text-book of Geology, by D. Page, 8vo., 7*s*. 6*d*. (Edinburgh, Blackwood, 4th ed., 1867.)

Physical Geography and Geology of Great Britain, by A. C. Ramsay, 8vo., 5*s*. (London, stamped, 2nd ed., 1864.)

Popular Physical Geology, by J. B. Jukes, 16mo., 5*s*. (London, Routledge, 1866.)

Text-book of Geology, by J. D. Dana, 12mo., 7*s*. 6*d*. (Philadelphia, 1864.)

Manual of Geology, by J. D. Dana, 8vo., 21*s*. (Philadelphia, 1863.)

A Handbook of Geological Terms, by D. Page, 8vo., 7*s*. 6*d*. (Edinburgh, Blackwood, 2nd ed., 1865.)

Recent and Fossil Shells, by S. P. Woodward (Weale's series), 18mo., 5*s*. 6*d*. (London, Weale, 1851.)

Glossary of Mineralogy, by H. Bristow, 8vo., 6*s*. (London, Longman, 1867.)

Other books that may be consulted :—

Siluria, by Sir R. I. Murchison, 8vo., 30*s*. (London, Murray, 4th ed., 1867.)

Geological Observer, by Sir H. De la Beche, 8vo., 18*s*. (London, Longman, 1853.)

Voyage of a Naturalist round the World, by C. Darwin, 8vo., 8*s*. 6*d*. (London, Murray, 1845.)

The Origin of Species, by C. Darwin, 8vo., 15*s*. (London, Murray, new ed., 1866.)

Catalogue of British Fossils, by J. Morris, 8vo., 10*s*. (London, Van Voorst, 1843.)
Chart of the Characteristic British Tertiary Fossils, by J. W. Lowry, mounted on linen, 10*s*. (London, Stanford.)
Chart of the Genera of Fossil Crustacea, by J. W. Salter and H. Woodward, mounted, 10*s*. 6*d*. (London, Stanford.)

SUBJECT XIII.—MINERALOGY.

First Stage or Elementary Course.

A. Instruction in this subject should commence with a distinct understanding of the characters and circumstances by which minerals, properly so called, are to be distinguished from other inorganic substances, and of the position of this science in relation to the collateral sciences of physics, chemistry, and geology. Definitions of a mineral, a crystal, and of the conditions termed crystalline and amorphous. Occurrence of other more or less regular forms not crystals. Distinction of compound masses or mixtures of minerals.

B. *Crystallography*, as the essential means of appreciating the forms naturally assumed, under favourable conditions, by almost all inorganic bodies of definite composition, must commence with the needful definitions; faces, edges, and solid angles; plane figures of three, four, five, six, and eight sides; the names and chief features of the more important geometrical solid figures which occur among crystals; the object of referring the faces to systems of axes, and the various directions in which these may be placed.

Method of drawing crystals isometrically.

Relation of the hemihedral to holohedral forms.

The grounds for grouping the various crystal forms into six systems.

Laws by which the derivation of one form from another within the limits of the same system is determined.

Complex or modified crystals may be regarded as combinations of the faces of two or more simple forms.

The leading figures of the six systems to be studied, with frequent practice in drawing.

Twin crystals and hemitropes; the relative position of the axes of their several portions.

Irregularities to which the surface of crystal faces is subject, certain angular elements remaining constant; measurement of these latter by instruments. Principles of the contact goniometer and of Wollaston's goniometer.

C. *Aggregation*, or natural grouping of—1stly, the distinctly crystallized minerals; 2ndly, of the crystalline minerals, especially with reference to structure and general form of masses of the useful minerals and of crystalline rocks.

D. *Other physical properties*.—The cleavage of crystallised substances, and its relation to crystalline form. Fracture, its various characters. Comparative hardness, how best determined. Different qualities of tenacity. Specific gravity of solids, how determined; the balance, the aræometer.

Property of magnetism; what substances are capable of being attracted by a magnet, and what is the comparative intensity of the effect. Polarity. Influence of certain minerals disseminated in rocks on the correctness of surveys.

Peculiarities of smell and of taste which distinguish a limited number of minerals.

E. *Optical characters.*—Single and double refraction, and their relation to certain crystallographical systems.

Different degrees of lustre and transparency.

Colour essential in some species, not so in others; varieties of colour, how far they are capable of definition.

Phosphorescence as produced by different methods and exhibited by certain minerals.

F. *Chemical characters.*—Simple or elementary substances; some of them occur as minerals; their symbols and the derivation of the same. Equivalents; chemical combinations; principal groups of these occurring in the mineral kingdom.

Dimorphism of particular substances, accompanied by a difference in other physical characters besides form.

The employment of acids in the discrimination of minerals.

The blowpipe, its form and uses; the reducing and the oxidizing flames. Trial of comparative fusibility, of the colour given to the flame, the incrustation on charcoal; the effects of fusing various metallic oxides with beads of borax glass.

Pseudomorphism.—The phenomena presented by minerals which have the composition of one mineral coupled with the form of another. Analogous action of fossilization or petrifaction.

G. General requirements of a system of classification of minerals.

H. The physiography or systematic description of minerals. This last division should include all the more remarkable varieties as well as species, and should take especial note of the modes and places of occurrence, as well as of the association of particular groups of minerals in certain veins or formations. Vague statements, such as giving the the locality of a mineral "Germany" or "North America," should be eschewed.

It would not be expected that the elementary course should include the description of the rarer substances, or of those species whose characters are not yet well ascertained, but attention should chiefly be given to those species which form the constituents of rocks and those which as ores supply the materials for the production of the useful metals.

Second Stage or Advanced Course.

A. Discussion of the relation of true minerals to other inorganic substances, and how far bodies of organic origin may be classed among minerals.

B. The dependence of symmetry in crystal forms on the axial system. The crystallographical value of a face is the same as that of any plane parallel to it, on the same side of the centre of the crystal. Position of the normals to a face. The methods of indicating the faces, and thence the entire forms of crystals by symbols. Drawing of a sphere of projection in which the poles of the crystal faces may be shown. Convenience of representing in a great circle the poles of a zone of faces. The magnitude of the angle between the normals being the supplement of the mutual inclination of the planes, the first kind of measurement (*i.e.* between the normals) is adopted by certain authors, and is easily reducible into the other kind. Statement of the angular and linear dimensions requiring to be determined for the description of the simple forms of all the systems after the cubical.

Twin crystals, the twin plane, and twin axes; examples of their position in important minerals of the several systems.

C. Reticulated, wiry, and capillary forms, explanations suggested for their formation. Other peculiarities in grouping.

D. The prevailing directions of cleavage in the several crystallographical systems.

Determination of the specific gravity of a substance contained in a mechanical mixture.

Electricity; by what means this property is exhibited in different minerals.

E. Refraction of light; different positions of the ordinary and extraordinary ray in doubly-refracting bodies. Optic axes of a crystal, their variation in different species of minerals.

Polarized light, its connexion with double refraction. Construction of the polariscope.

Dichroism and pleochroism, a remarkable property of some few minerals.

F. Character of the chemical composition of the more complex minerals.

The electro-negative element in chemical combinations has the preponderating effect in influencing the external character.

Isomorphism, as shown by Mitscherlich, to result from a group of—1st, isomorphous acids; 2nd, of isomorphous bases. Polymeric isomorphism of Scheerer; its meaning, and the arguments in its favour. Vicarious or irregular replacement among one another of isomorphous constituents.

Testing of minerals in the moist way simply practicable for qualitative purposes.

Treatment of various metallic ores before the blow-pipes.

Pseudomorphous substances as arranged in groups according to the nature and degree of change they have undergone.

Discussion of anogenic and katogenic pseudomorphs, or those which have been produced above by oxidizing, and below by reducing processes respectively.

Extension of pseudomorphous action on a large scale to "gossans" and to geological formations.

G. Methods of classification as proposed by the leading authors in mineralogy. Review of the difficulties caused in classification by the occurrence of the isomorphous substances.

Discussion of the means of defining a species among minerals.

H. Species and varieties of minerals as described in the best manuals. Their occurrence under various circumstances to be particularly studied. The changes in composition wrought by nature (pseudomorphous action), by which one species is converted into another, and the essential points of difference between species much alike in certain characters, will be held of much importance in dealing with the minerals of special value or interest. It is not expected that the memory should be charged with the details of substances of very rare occurrence, or of doubtful independence as species.

Examination for Honours.

The questions will as a general rule be such as are embraced in the above syllabus, but candidates will be required to prove a practical acquaintance with minerals and with crystal forms, and will need to have studied some of the more advanced works mentioned below.

Text Books.

As text-books may be mentioned—

Elementary Course of Mineralogy and Geology, by D. T. Ansted, 8vo., 12*s*. (London, Van Voorst, 1856.)

Elements of Mineralogy, by Jas. Nicol, 12mo., 5*s*.
(London, Longman, new ed., 1858.)
Manual of Mineralogy, by J. D. Dana, 8vo., 7*s*. 6*d*.
(New York, new ed., 1860.)
Glossary of Mineralogy, by H. W. Bristow, 8vo., 6*s*.
(London, Longman, 1867.)
The Mineralogist's Directory, by Townshend Hall.
(London, Stamford, 1868.)

For more advanced students—

Elementary Introduction to Mineralogy, by Brooke and Miller. 8vo. 18*s*. (London, Simpkin, 1852.)
Crystallography, by Rev. W. Mitchell, in Orr's "*Circle of the Sciences*." 8vo. 3*s*. (London, Griffin.)
System of Mineralogy, by J. D. Dana, 8vo., 36*s*.
(New York, 5th ed., 1868.)
Introduction to the use of the Blowpipe, by Scheerer, translated by H. Blanford. (London, Williams and Norgate, 1856.)
Elemente der Mineralogie, von C. F. Naumann, 8vo, 9*s*.
(Leipzig, Engelmann, 7th ed., 1868.)
Paragenesis der Mineralien, von. A. Breithaupt, 8vo., 5*s*. 6*d*.
(Freiberg, Engelhardt, 1849.)
Handbuch der Mineralogie, von W.Haidinger, 8vo., 10*s*.
(Vienna, Braumüller, new ed., 1865.)
Manuel de Minéralogie, par Des Cloiseaux, Tome I., 8vo., 17*s*.
(Paris, Dunod, 1862.)
Manual of the Mineralogy of Great Britain and Ireland, by Greg and Lettsom, 8vo., 15*s*. (London, Van Voorst, 1858.)

When it is intended to teach this subject with special reference to the practical working of minerals, the physiographical part will be occupied more particularly with certain of the useful species and their associated substances, and the following works may be consulted:—

The Metalliferous Deposits of Cornwall and Devon, by W. J. Henwood. 1843.
Bischof's Chemical and Physical Geology, translated by the Cavendish Society, 2 vols., 8vo., 21*s*. (London, 1854.)

SUBJECT XIV.—ANIMAL PHYSIOLOGY.

First Stage or Elementary Course.

Questions will be confined to the under-mentioned topics.

A. Anatomical Preliminaries.

The general build of the human body.

The meaning of the terms skull, vertebra, rib, sternum; scapula, clavicle, humerus, radius, ulna, carpus, metacarpus, phalanges (of the hand); pelvis, femur, tibia, fibula, tarsus, metatarsus, phalanges (of the foot); integument, mucous membrane, connective tissue, tendon, ligament, cartilage, muscle, nerve.

The position in the body and the general form and size of the following internal parts:—The brain and spinal cord; the pharynx, the gullet, stomach, and intestines; the salivary glands, the liver and pancreas; the

posterior nares, the larynx, trachea, and lungs; the kidneys and bladder; the heart and the great vessels; the thoracic duct, and the chief lymphatic glands; the spleen; the diaphragm.

B. Chemical Preliminaries.

The composition of air, water, carbonic acid, and ammonia.

The chemical elements of which protein, fat, and sugar are composed.

The nature of the most important mineral compounds which are formed in the body.

The ultimate chemical products of the decay and putrefaction of the dead body.

C. General View of the Animal Body in Action.

The evidence that the body constantly wastes during life; the nature of the waste products, and of the compensation for waste; the essential characters of food stuffs.

The part played by oxygen in the economy.

The number, position, and uses of the sensory organs.

The nature of cilia and the movements to which they give rise.

The physiological properties of muscular tissue.

The modes in which muscles give rise to movements and sustain the body in the erect posture.

The physiological properties of nervous tissue.

The general functions of the brain and of the spinal cord.

Local and general death.

D. Special Physiology.

a. The circulatory Organs.

The arrangement of the chambers of the heart and of its valves.

The general differences between arteries, veins, and capillaries.

The course of the circulation of the blood and the reasons why the blood moves only in one direction.

The meaning of the beat of the heart, of the pulse in the arteries, and of the jet-like flow of blood from a cut artery.

The evidence of the circulation obtainable in the living body.

b. The Blood.

The phenomena presented by blood drawn from the body.

The general nature of the corpuscles of the blood.

The general composition of the blood.

The difference between blood and lymph.

c. Respiration and other processes which modify the condition of the Blood.

The obvious differences between arterial blood and venous blood.

How venous blood can be converted into arterial blood out of the body.

How and where venous is converted into arterial blood in the body.

How the air which leaves the lungs differs from that which enters them.

The general nature of the respiratory movements.

The course of the air, when breathing takes place through the nose.

The conditions which give rise to asphyxia.

The essential composition of the urine.

The general structure of the apparatus by which its separation from the blood is effected.

The essential composition of the sweat.
The general structure and functions of the skin.
The manner in which the blood enters and leaves the liver.
The products yielded by the liver to the blood directly, and through the medium of the alimentary canal.
The chief characters of the bile. The use of the gall-bladder.
The source of the heat of the body. The manner in which the temperature of the body is distributed and regulated.

d. Alimentation.

The quantity of dry solid and gaseous aliments required daily by an adult man.
The classification of food stuffs.
The economy of a mixed diet.
What becomes of proteid, fatty, amyloid, and mineral food stuffs respectively.
The nature and functions of the salivary, gastric, and pancreatic secretions.
The manner in which nutritive matters are absorbed, and innutritious matters excreted, from the alimentary canal.

e. Animal Mechanics.

The different kinds of levers and their exemplifications in the body.
The nature of joints, with examples of ball and socket, hinge and pivot-joints.
The conditions of the production of the voice.
The difference between voice and speech.

f. The Senses and their Organs.

The general structure of the organ of touch.
The means of measuring the acuteness of the sense of touch in different parts of the body.
The general structure of the organs of taste and of smell.
The external auditory passage and the tympanic membrane.
The tympanum and how it opens into the pharynx.
The chain of ear bones and their connection on the one hand with the tympanic membrane, and on the other with the membrane of the fenestra ovalis.
The form of the membranous labyrinth and of the cochlea. The nature of the endolymph and perilymph and of the otoconia. The relation of the auditory nerve to the labyrinth.
The manner in which the impact of sound-waves on the tympanic membrane affects the auditory nerve.
The eyelids, and the manner in which they are moved. The lachrymal apparatus. The form of the eyeball; its general structure, and the functions of its component parts.
The manner in which the movements of the eyeball are effected.
The blind spot. The duration of luminous impressions. Colour-blindness.

g. The Nervous System.

The difference between the cerebro-spinal and the sympathetic systems.
The nature and functions of the roots of the spinal nerves.
The evidence that the spinal cord is capable of effecting reflex action.

The nature and functions of vaso-motor nerves.

The most important functional peculiarities of the medulla oblongata.

The evidence that the higher faculties of the mind have their seat in the brain.

The number, names, and functions of the cerebral nerves.

SECOND STAGE OR ADVANCED COURSE.

In addition to the preceding, a knowledge of the following subjects will be required :—

a. The Circulatory System.

The minute structure of the organs of circulation. The manner in which they are supplied with blood and with nervous energy. The nature of the pericardium.

The detailed analysis of the movements and sounds of the heart, and of the phenomena of the pulse. The causes of blushing and of pallor. The influence of the respiratory movements on the circulation. The effect of irritation of the pneumogastric nerve upon the heart's action.

The structure of the lymphatic vessels and glands, and the connexion of the lymphatic, with the blood vascular, system.

b. The Blood, the Lymph, and the Chyle.

The sizes and the structure of the corpuscles of these fluids. The phenomena which they exhibit. Their probable functions. The composition of the blood in detail. The nature of the process of coagulation.

c. The Respiratory System.

The structure of the thorax. The pleuræ. The structure of the respiratory organs and the distribution of the blood through them. The analysis of the respiratory movements in detail. The mechanism by which coughing, sneezing, sighing, and hiccoughing are effected. The physical and chemical processes involved in the conversion of inspired into expired air, and of venous into arterial blood. The quantity of waste products excreted and of oxygen taken in by the lungs in twenty-four hours. The rationale of ventilation.

The Urinary System.

The minute structure of the kidney, ureter, and bladder.

The circulation in the kidney and the changes which the blood undergoes in passing through it.

The quantity of waste products of all kinds excreted by the kidneys in 24 hours.

The Skin.

The minute structure of the skin, of the hairs, nails, and glands connected with it. The muscles of the hair-sacs.

The quantity of waste products excreted by the skin in 24 hours.

The Liver.

The structure of the liver, and the course of the blood through it. The arrangement of the ducts of the liver. The composition of the bile, and the quantity of that fluid secreted daily. The functions of the bile. The nature and uses of glycogen.

The Spleen and the other Ductless Glands.

The structure and probable functions of these organs.

The Alimentary Canal.

The structure, forms, kinds, and succession of the teeth. The structure and functions of the salivary glands. The structure and functions of the tongue, the soft palate, uvula and tonsils. The pharynx and the œsophagus and the structure of their walls. The stomach, its form; the structure of its walls; its glands and their functions. The divisions of the intestine. The structure of its walls. Villi. Glands. Peyer's patches. The structure and functions of the pancreas. The peritoneum and the nature of the mesentery.

The details of the digestive and absorptive processes. The profits and losses of the economy, and how they are balanced during health.

The Muscular System and Animal Mechanics.

The minute structure of fibrous, cartilaginous, bony, and muscular tissue.

The physical, chemical, and physiological properties of muscle. Rigor mortis. The mechanism of standing, walking, running, and jumping.

The structure and working of the larynx. The mode in which consonantal and vowel sounds and articulate speech are produced.

The Senses.

The structure of the papillæ of the skin, and of the tactile corpuscles.

The muscular sense.

The minute structure and nervous supply of the tongue as a sensory organ.

The structure of the olfactory organ. The nature and extent of the air chambers connected with it. The minute structure of the Schneiderian membrane and of the olfactory nerve-fibres. The mechanism of smelling.

The structure of the ear. The external ear and the muscles which move it. The muscles connected with the ear bones and their actions.

The minute structure of the membranous labyrinth and cochlea. The probable functions of these organs.

The minute structure and the properties of the various constituents and coverings of the eyeball. Complementary colours. Phosphenes. Purkinje's figures. Adjustment. Regulation of light. Double vision with one eye.

Sensations and Judgments.

The notion of roundness. Subjective sensations. Ventriloquism. Erect vision. Double vision and single vision with two eyes. Judgments of distance and form. The pseudoscope and the stereoscope.

The Nervous System.

The structure of ganglionic corpuscles and of nerve fibres.

The structure of the investments of the brain and spinal cord.

The minute structure of the spinal cord. The general disposition of the histological elements of the brain.

The names and positions of the larger divisions of the brain and of its ventricles.

The origins and functions of the spinal and cerebral nerves in detail.

The effect of cutting the spinal cord in various ways, and of injuries to the medulla oblongata.

The effect of removing the hemispheres of the brain.

Unconscious cerebration and acquired reflex action.

Reproduction.

The structure of the ovum and of the spermatozoon.

The process of yelk division.

The formation of the blastoderm and the development therefrom of the body of the embryo, with amnion, allantois, and yelk sac.

The nature of the chorion, of the decidua, and of the placenta.

The mode in which the fœtus is nourished.

The development of the heart and the fœtal circulation. The changes in the circulation which take place at birth.

The lacteal glands and lactation.

The modifications in the proportions of the body from birth to adult age.

The general modifications in the condition of the skeleton from its earliest appearance. The notochord. The process of ossification.

The thymus and thyroid glands.

The two dentitions.

Examination for Honours.

Candidates will be examined in any subject treated of in the standard English works upon Physiology, such as Carpenter's *Principles of Human Physiology*, and Marshall's *Outlines of Human and Comparative Physiology*.

Text Books.

For the elementary stage—

Lessons in Elementary Physiology, by T. H. Huxley, 18mo., 4*s*. 6*d*. (London, Macmillan, 1868.)

For the advanced stage, in addition to the above:—

A Manual of Physiology, by W. B. Carpenter, 12mo., 12*s*. 6*d*. (London, Churchill, 4th ed., 1865.)

Handbook of Physiology, by W. S. Kirkes, 8vo., 12*s*. 6*d*. (London, Walton and Maberly.)

A Description of the Human Body, its Structure and Functions, by J. Marshall, 2 vols., 4to. 21*s*. (London, A. Tarrant, 2nd ed., 1870.)

SUBJECT XV.—ZOOLOGY.

N.B.—Students should have been instructed in the elements of physiology before commencing the study of Zoology. After May 1869 no candidate will be passed in Zoology unless at the same, or at a previous, examination he has been passed in the elementary stage of Animal Physiology.

First Stage or Elementary Course.

Questions will be confined to the following topics:—

The characteristic and distinctive features of the following groups of animals:—*Vertebrata, Mammalia, Aves, Reptilia, Amphibia, Pisces, Arthropoda, Insecta, Myriapoda, Arachnida, Crustacea, Annelida, Echi-*

nodermata, *Rotifera*, *Infusoria*, *Spongida*, *Foraminifera*, *Cœlenterata*, *Hydrozoa*, *Actinozoa*, *Polyzoa*, *Brachiopoda*, *Lamellibranchiata*, *Pulmo-gasteropoda*, *Branchio-gasteropoda*, *Cephalopoda*.

(Candidates will be expected to be able to refer any British member of one of these groups to its proper group.)

The general nature and arrangement of the skeleton (or hard parts) in *Foraminifera*, *Spongida*, *Hydrozoa*, *Actinozoa*, *Brachiopoda*, *Lamellibranchiata*, *Gasteropoda*, *Echinodermata*, *Arthropoda*, *Vertebrata*.

The general nature and working of the alimentary apparatus observed in *Infusoria*, *Hydrozoa*, *Actinozoa*, *Polyzoa*, *Gasteropoda*, *Annelida*, *Arthropoda*, *Pisces*, *Aves*, *Mammalia*.

The general structure and working of the organs of circulation and respiration in *Lamellibranchiata*, *Gasteropoda*, *Crustacea*, *Arachnida*, *Insecta*, *Pisces*, *Amphibia*, *Reptilia*, *Aves*, *Mammalia*.

The general nature of the nervous system in *Rotifera*, *Echinodermata*, *Annelida*, *Arthropoda*, *Polyzoa*, *Lamellibranchiata*, *Vertebrata*.

The principal characters of the organs of hearing in *Lamellibranchiata*, *Crustacea*, *Pisces*, and *Mammalia;* and of the organ of sight in *Annelida*, *Arachnida*, *Insecta*, *Gasteropoda*, and *Vertebrata*.

The general nature of the process of development in *Hydrozoa*, *Lamellibranchiata*, *Crustacea*, *Insecta*, *Amphibia*, and *Aves*.

Text Books.

A Manual of Zoology. Vol. I. Invertebrate Animals. By H. A. Nicholson. Crown 8vo. *7s. 6d.* Blackwood and Sons.

Introduction to the Classification of Animals. By T. H. Huxley, LL.D., F.R.S. 8vo. *6s.* Churchill and Sons.

Second Stage or Advanced Course.

Questions may be set in all subjects enumerated under the Elementary Stage, and in addition on the following topics:—

The characters and distinctive peculiarities of the *Nematoidea*, *Acanthocephala*, *Turbellaria*, *Trematoda*, *Ascidioida* (or *Tunicata*), *Pteropoda*, *Radiolaria* (or *Polycistina*), *Gregarinida*, *Rhizopoda ;* and of the principal subdivisions (orders) of the *Mammalia*, *Aves*, *Reptilia*, *Amphibia*, *Pisces*, *Insecta*, *Arachnida*, *Crustacea*, *Annelida*, *Echinodermata*, *Hydrozoa*, *Actinozoa*, *Brachiopoda*, *Lamellibranchiata* *Gasteropoda*, *Cephalopoda*.

Reference of any specimen to its proper class and order.

The most important modifications of the vertebrate skeleton observable in *Pharyngobranchii*, *Marsipobranchii*, *Elasmobranchii*, *Teleostei*, *Chelonia*, *Ophidia*, *Aves*, *Monotremata*, *Marsupialia*, *Cetacea*, *Cheiroptera*, *Ungulata*, *Simiadæ*, *Man*.

The leading modifications of the appendages of the body and head in the *Arthropoda*.

The structure of the test in *Echinus*, *Uraster*, and *Comatula* (*Antedon*).

The structure and nomenclature of the parts of the shell in *Brachiopoda*, *Lamellibranchiata*, *Gasteropoda*, and *Cephalopoda*.

The structure of the corallum in the *Actinozoa*.

The structure, succession, and chief forms of the teeth in *Mammalia*. The dental formulæ of Man, of old and new world apes; of the hedgehog, the dog, the cat, the horse, the ox, the pig, the rabbit, and the rat.

The structure and mode of formation of "whalebone."

The structure and movements of the beaks of *Aves* and *Chelonia*.

The poison fangs of snakes and the mechanism by which they are moved.

The teeth of ordinary fishes, of sharks, rays, *Chimeræ*, and lampreys.

The alimentary apparatus of the *Ruminantia*, and the mode in which it works.

The leading forms assumed by the circulatory, respiratory, renal, hepatic, and salivary organs in the animal series.

The modifications of the brain and of the sensory organs in the *Vertebata*, *Arthropoda*, *Cephalopoda*, and *Gasteropoda*.

The leading forms of the reproductive apparatus, with the general process of development, in *Mammalia, Aves, Reptilia, Amphibia, Pisces, Arthropoda, Annelida, Echinodermata, Trematoda, Tæniada, Spongida, Cœlenterata, Lamellibranchiata, Pulmo-gasteropoda, Branchio-gasteropoda, Cephalopoda*.

The distribution of animals. The principal forms of animal life characteristic of Australia; of South America, with Mexico; of Africa, south of the Sahara; of Hindostan; of Central Asia, with Europe and North Africa; of America, north of Mexico; of the Atlantic, the Indo-Pacific, the Arctic and Antarctic Oceans.

The broad facts relating to the succession of animal life upon the globe.

The natural history of the animals which supply articles of commerce.

Examination for Honours.

In this examination questions will be set at the discretion of the Examiner, who will have regard to the state of Zoological teaching in the country and the means of acquiring information.

SUBJECT XVI.—VEGETABLE ANATOMY AND PHYSIOLOGY.

The examiner in botany finds that the number of candidates in vegetable physiology is always much greater than in systematic botany. He ventures to suggest to the teachers that, considering the age of most of their pupils, it would be better to begin with systematic botany, and not to teach vegetable physiology till the pupil has passed the first stage, at least, of Subject XVII. The teaching would thus be more practical, and would be confined chiefly to the plants of the district and to the common garden plants.

The teaching should be carried on in the field, if possible, or in any case by means of fresh specimens rather than drawings.

I. First Stage or Elementary Course.

Distinctions between flowering and flowerless plants. Growth of flowering plant from seed. Plumule, radicle, cotyledons.

Ascending and descending axis: axial and appendicular organs.

Cells: Parenchyma, prosenchyma, ducts, spiral vessels. Vascular bundles.

Structure and growth of root. Spongioles.

Structure of stem. Pith, wood, bark, medullary rays.

Epidermis. Hairs, prickles.

Nature, position, and development of leaf buds: branches and spines.

Venation and structure of leaves. Stomates.

Floral organs, protective and essential. Sexes of plants.

Structure and dehiscence of anthers. Structure of pollen grain. Evolution and course of pollen tube.

Stigma. Ovule: nucleus and coats, foramen. Anatropous campylotropous and orthotropous ovules. Impregnation. Embryo sac.

Seed: hilum, chalaza, rhaphe. Albumen. Embryo: monocotyledonous and dicotyledonous.

Food of plants. Course of sap, osmose, exhalation, respiration (by day and night), assimilation. Cambium layer.

Composition of cellulose, starch, sugar, gum, gluten, chlorophyll.

In the earlier course these subjects should be taught quite generally, as they occur in the ordinary type of structure. All exceptions should be reserved for the higher course.

Second Stage or Advanced Course.

Cell development by division and free cell formation. Protoplasm. Formation of ducts and vessels.

Cell contents. Cytoblast or nucleus, secondary deposits, air, crystals, rhaphides, chlorophyll, oil.

Circulation of fluids in cells.

Functions of cells and vessels. Intercellular spaces, latex canals.

Structure of trunk of climbing plants, and of tree ferns.

Parasitical plants; leafy and leafless, on root, stem, bark.

Development of leaves.

Abnormal forms of stomates.

Pollen formation.

Ovule of Loranthaceæ.

Impregnation and embryogeny of Conifers and their allies.

Reproduction of Cryptogams.

Propagation of plants otherwise than by seed.

Physiology of flower; absorption of oxygen, evolution of heat.

Irritability of leaves, tendrils, stamens.

Theory of manures.

Differences between animals and plants.

Examination for Honours.

Questions will be set at the discretion of the examiner, who will have regard to the state of botanical learning in the country and the means of acquiring information.

Text Books.

See end of next subject.

SUBJECT XVII.—SYSTEMATIC AND ECONOMIC BOTANY.

First Stage or Elementary Course.

A.—Morphology.

Ascending and descending axis.

Root: annual, biennial, perennial; fibrous, tuberous, tap, &c.

Stem: woody or herbaceous; erect or creeping; corm, bulb, rhizome.

Leaf: entire or variously cut; simple or compound; kinds of composition. Petiole, blade.

Stipules. Tendrils. Bracts.

Inflorescence: raceme, spike, catkin, umbel, capitulum, corymb, panicle.

Flower: complete or incomplete, uni- or bi-sexual; regular or irregular.

Calyx and corolla: poly- or gamo- sepalous or petalous; persistent or deciduous; valvate, imbricated or twisted in estivation.

Stamens: number and relative position; insertion, cohesion. Filament, anther.

Ovary: adherent or free; of one or more carpels, uni- or multi- locular; number and cohesion of styles.

Ovules: solitary or numerous; erect, horizontal, or pendulous; with axile, free central or parietal placentation.

Fruit: dehiscent or indehiscent; succulent or dry; drupe, berry, achene, capsule, legume, pod.

B.—Classification.

Dicotyledones: thalalamifloræ, calycifloræ, corollifloræ, incompletæ.
Monocotyledones.
Acotyledones: acrogens, thallogens.
Distinctive characters of the largest British natural orders, viz.:—

Ranunculaceæ.	Scrophulariaceæ.
Cruciferæ.	Labiatæ.
Caryophylleæ.	Orchideæ.
Leguminosæ.	Liliaceæ.
Rosaceæ.	Cyperaceæ.
Umbelliferæ.	Gramineæ.
Compositæ.	

C.—Economic Botany.

The candidate will be expected to know the economic plants indigenous to Great Britain and Ireland, as well as those contained in the following list:—

Wheat.	Gum.	Teak.
Barley.	Caoutchouc.	Maple.
Oats.	Gutta Percha.	Walnut.
Rye.	Turpentine.	Opium.
Rice.	Palm oil.	Quinine.
Indian corn.	Cocoanut oil.	Jalap.
Pea.	Castor oil.	Ipecacuanha.
Bean.	Olive oil.	Aloes.
French bean.	Indigo.	Rhubarb.
Pasture Grasses.	Logwood.	Senna.
Clover.	Madder.	Nutmeg.
Turnip.	Catechu.	Cloves.
Mangold.	Galls.	Pepper.
Hops.	Oak bark.	Orange.
Tea.	Cotton.	Vine.
Coffee.	Flax.	Almond.
Cocoa.	Hemp.	Peach.
Chicory.	Jute.	Plum.
Tobacco.	Mahogany.	Melon.
Starch.	Oak.	Cucumber.
Sugar.	Deal.	Gourd.

The use of the product, the part of the plant affording it, the name and natural order of the plant which yields it, its native country when wild, and when cultivated the area of cultivation will be expected to be known.

SECOND STAGE OR ADVANCED COURSE.

Modifications of stem structure (as in cactus, &c.)
Modifications of leaf structure: Phyllodes, pitchers.

Morphology of cryptogams: frond, thallus, theca or spore-case, sorus, elater, mycelium, spore, &c.
Phyllotaxis.
Theory of Inflorescence.
Metamorphosis of flowers.
Dimorphism of flowers.
Principles of classification.
Natural family or order, genus, species, variety.
Variations of cultivated plants.
Characters of all British natural orders, and of the largest and most important exotic orders.
Classification of Cryptogams: characters of ferns, Lycopodiaceæ, Equisetaceæ, mosses, Hepaticæ, Characeæ, Algae, Lichens, Fungi.
Principal economic plants belonging to each natural order.
General principles of geographical botany.

Examination for Honours.

Questions at the discretion of the examiner, who will have regard to the state of botanical learning in the country and the means of acquiring information.

Text Books.

Asa Gray.	*Lessons in Botany.* One dollar.	(Phinney, New York.)
Balfour.	*Outlines of Botany.* Fcap. 8vo. 7*s.*	(A. and C. Black.)
,,	*Class Book of Botany.* 31*s.* 6*d.*	
,,	,, ,, In two parts, at 10*s.* 6*d.* and 21*s.*	(A. and C. Black.)
,,	*Manual of Botany.* 10*s.* 6*d.*	(A. and C. Black.)
Bentley.	*Manual of Botany.* 12*s.* 6*d.*	
Henfrey.	*Elementary Course of Botany.* 12*s.* 6*d.*	
,,	*Rudiments of Botany.* 3*s.* 6*d.*	(Van Voorst.)
Lindley.	*School Botany.* 5*s.* 6*d.*	(Bradbury and Evans.)
,,	*Systematic and Descriptive Botany.* 3*s.*	(Society for Diffusion of Useful Knowledge.)
,,	*Vegetable Kingdom.* 36*s.*	(Bradbury and Evans.)
Botany, Structural, Physiological. 3*s.*		(Society for Diffusion of Useful Knowledge.)
Treasury of Botany, in two parts. 10*s.*		(Longmans.)
Oliver.	*Lessons in Elementary Botany.* 4*s.* 6*d.*	(Macmillan.)

SUBJECT XVIII.—PRINCIPLES OF MINING.

The Art of Mining embraces so wide a field of study that equal practical proficiency in its various branches is not to be expected from persons engaged in different classes of mines, nor equal knowledge of its general features from students brought up in districts where only one or another branch of the subject is practised. The examination papers will therefore contain a sufficient variety of questions to suit candidates belonging to either a metalliferous or a coal district.

The subject at large being properly an art, or application of various branches of science, and one in which every question will admit of various degrees of proficiency being shown in the replies, the higher numbers will be awarded only to those answers which exhibit the greater

amount of completeness and accuracy. Curt and vague answers will be but of little value, and exactness will be expected in all that relates to numbers, prices, weights, and measures.

Those who wish to gain a general knowledge of the topics for examination may be recommended to direct their attention to the subjoined heads, viz.:—

First Stage or Elementary Course.

1. Geology and Mineralogy, more particularly those portions of the sciences which bear on the following subjects,—the nature and position in the earth's crust of the useful minerals, the classes of rock with which they are severally associated, the special character of heaves, throws, troubles, and all kinds of dislocation; the particular differences between beds and lodes, and their minerals, and the chief features of irregular repositories.
2. The methods of prospecting and searching at surface for ores and other minerals.
3. Breaking rock by manual labour alone; various forms of pick, and of hammer and wedge employed for the purpose. Use of gunpowder and other explosives; precautions to be observed in boring and in firing shots.
4. Depths attained by mines and bore holes in various cases. Geographical distribution of the chief mining districts.
5. Ventilation of mines, why important. Composition of air, carbonic acid gas, and fire-damp; how the latter noxious damps occur, and what precautions against them should be adopted, either for a temporary purpose or permanently. Reasons of a natural circulation of air to some extent being observable in all mines. Various applications of water to aid ventilation. Means of applying heat, or machines for the same purpose.
6. Lighting of workings; principle and construction of the safety lamp.
7. Circumstances under which water enters mines. Working of ordinary pumps; special requirements of pumps for mines. Mode of applying human or horse labour to the winding of water and stuff or mineral; fixing and comparison of the unit of work. Water wheels and steam engines, variety and construction of, as in use for mining purposes.

   Carriage or conveyance along levels and inclines; barrows, tram-plates, rails, tubs, or wagons.

   General features of winding in shafts by machinery.
8. The form and dimensions of shafts applied to various purposes; sinking, and precautions against accident from falls and from collapse of sides.
9. Driving of levels, drifts, and wind-roads; their rate of inclination, breadth, and height in various districts; methods and cost of arching them, and of timbering or wooding.
10. The removal or *exploitation* of mineral after completion, to a certain point, of dead work; stopes and pitches, under various circumstances. Pillar-working at various depths, and other forms of extracting coal or ironstone. Main considerations of safety and economy which have to be studied in adopting a particular plan.
11. Means of security to be adopted in shafts; 1st, as to construction and fixing of ladders; 2nd, as to rules and arrangements where the men ride instead of climbing.

Second Stage or Advanced Course.

1. Details as to the form in which the useful minerals are accumulated; stratified deposits; alluvial or stream-works; lodes and their various directions; pipes and other irregular repositories. Examples of remarkable localities; true sectional drawings or profiles to be studied. Examples of heaves, and alleged laws according to which they have taken place. Composition and physical state of the containing rock or "country."
2. Exploring, shoading, and costeaning. Grounds for opinion in the re-opening of old mines; preliminary operations in virgin districts.
3. Breaking of ground; the various implements employed, their form, dimensions, and weight; boring for shots; the various modes of firing charges. Heavy charges, how calculated and fired; rules for ensuring safety. Drilling and coal-cutting machines.
4. Deep boring, under what circumstances applicable,—apparatus for; description of varieties in use; lining of bore-holes.
5. Management and supervision; payment of men employed at mines, at surface and underground, varying in principle with the different classes of operation; reasons for tut-work or piece-work, and tribute or bing-tale under different circumstances. Calculations for cost of driving, sinking, tramming, &c.
6. Physical principles of ventilation; practice of mines where simple natural ventilation is employed; ventilation of large areas and of deep or complicated workings by guiding the natural current; artificial means, and their details, for promoting ventilation. Precautions to be taken under specially dangerous conditions.
7. Illumination, of various kinds, their economy; safety lamps in all their best modifications; circumstances under which they should be employed; precautions in their use.
8. Mechanical division of the subject. Strength of materials used in mines; human and horse power, principles and construction of machines to which they are applied. Hydraulic machines: construction of the water-wheels, turbines, and pressure engines most suitable to the various operations of mining. Steam engines, for pumping and for winding; arrangement and construction of the varieties most in use. Form and dimensions of boilers. Pumps employed in mines, mode of placing them; construction of the lifts; materials and details of the rods, set-offs, counterbalances, cisterns, and catches. Circumstances under which dams are erected in shafts or levels; mode of building them.

   Tubbing of water from shafts; conditions under which it may be done; details of the operation with various materials, wood, brick, stone, cast and wrought iron.

   Rails, waggons, and tubs for underground conveyance; employment of horses and of fixed steam engines for this purpose.

   Raising of the mineral through the shafts; various methods in use; chains, ropes (of hemp or wire), their weight, &c. Details of the best application of drums, cages, guides, keeps, and safety doors. Pulleys and shaft frames or poppet heads; protection against overwinding; safety clutches, &c. in case of breakage of rope.
9. Opening of ground; quarries and open work; driving of levels, various dimensions and directions according to circumstances; sinking of shafts, inclined or perpendicular; advantages of either kind under certain conditions; means of securing levels and shafts by timber or by walling; details of the various methods. Driving or sinking in heavy or running ground.

10. Working excavations; plan of laying them out, and means of security to be adopted whilst they are kept open. This will include the stoping of metalliferous veins, and the various modifications of post and stall, long-work, &c., which are applied to stratified deposits.
11. Travelling in shafts; prevention of accidents by proper fitting and dividing; mode of placing ladders and sollars; lifting machine for men, construction and advantages of.
12. Dressing of minerals. Arrangement of dressing floors. Construction of crusher and stamps; washing of coal; jigging, concentration, and separation of metallic minerals.

Examination for Honours.

Questions will be set at the discretion of the Examiner, who will have regard to a general knowledge of mining as carried on in this and other countries, and may require certificates from employers as to practical work.

Text Books.

The student may be advised among other sources of information to consult the following works:—

Manual of Geology, by J. Phillips. 8vo. 12s. 6d. (London, Griffin, 1855.)

Report on Cornwall, &c., by H. T. De la Beche. (London, Longman & Co., 1839.)

Laws regulating the Deposition of Lead Ore in Veins, by W. Wallace) 8vo. 25s. (London, Stanford, 1861.)

Treatise on Mining Engineering, by G. C. Greenwell. 4to. 50s. (London, Spon, 1856.)

Coal and Coal Mining, by W. W. Smyth. 8vo. 7s. 6d. (London, Strahan, 1869.)

Metallic Wealth of the United States, by J. D. Whitney. 8vo. 16s. (London, Trübner, 1854.)

Mining and Metallurgy of Gold and Silver, by J. Arthur Phillips. (London, Spon, 1867.)

Miners Manual of Arithmetic and Surveying, by W. Rickard. (London, Longman, 1859.)

Géologie Appliquée, par A. Burat. 2 vols. 8vo. 17s. (Paris, Langlois, 4th ed., 1859.)

Die Lehre von den Erzlagerstätten, von B. von Cotta. 2 vols. 8vo. 15s. (Leipzig, Felix, 2nd ed., 1861.)

Besides these the various reports of H. M. Inspectors of Coal Mines, and the evidence given before Committees of the Houses of Parliament on *Accidents in Mines*, may be studied with advantage.

Works on Mining, in addition to the above list, which should be kept for reference in a library:—

Section of the Strata, &c., by Westgarth Forster. 1821.

Transactions of the Northern Institute of Mining Engineers.

The Waterworks of London, by Colburn and Man. 7s. 6d. (Spon, 1867.)

Exploitation des Mines, par C. Combes. 3 vols. 8vo., and Atlas of plates. (Paris, 1844–46.)

Mineral Veins of Swaledale, by Lonsdale Bradley. 8vo., 21s. (London, Stanford, 1862.)

Memoirs of Geological Survey of Great Britain. Vol. I., 21s.; vol. II., 42s. (Longmans, 1848.)

Lehrbuch der Aufbereitungs-kunde (dressing of ores) by Rittinger. (Berlin, Ernstundkorn, 1867.)

Geology of Sandander and Madrid, by Sullivan and O'Reilly. 8vo., 10s. (London, Williams and Norgate, 1863.)

History of the Coal Trade, by Matthias Dunn.

Winning and Working of Coal Mines, by Matthias Dunn.

The Goldfields of Victoria, by R. Brough Smyth, 1869. Royal 8vo., 25s. (Trübner, Annales des Mines, Paris.)

SUBJECT XIX.—METALLURGY.

For the first stage or elementary course the student will be expected to answer questions under the following heads, exclusive of those in italics.

The second stage or advanced course will include these. The student will also be required to make sketches and name unlabelled specimens.

For honours the candidates will be asked questions at the discretion of the Examiner, who will have regard to the present state of metallurgical science as carried on in this and other countries.

Introductory Subjects.

Physical Properties of Metals.—Physical State. Action of Heat. Specific Gravity. Crystallization. Varieties of Fracture. Malleability. Ductility. Tenacity. Toughness. Softness. Elasticity. Conduction of Heat and Electricity. Capacity for Heat. Expansion by Heat. Opacity. Lustre. Colour.

Classification of Metallurgical Processes.

Explanation of the terms—Ore, "native" veinstuff, matrix or gangué, "dressing." Reduction. Smelting. Flux and Slag. Regulus. Speise. Roasting. Distillation. Sublimation. Liquation.

Slags.—Atomic constitution of silicates. Constitution, external characters, brittleness, toughness, colour, and fusibility of slags. The fusibility of certain compounds not containing silica, aluminates, &c. Sesquioxide of iron and lime. Fluor spar as a flux. *Melting points of silicates as indicated by the fusion of alloys of gold and platinum. Supposed sulphosilicates.*

Natural Refractory Materials employed in the Construction of Crucibles, Retorts, Furnaces, &c. Fire Clays.—Approximate composition. Mode of testing. Crucibles.—Earthen or clay crucibles. *Stourbridge clay crucibles. Cornish crucibles. London crucibles. Hessian crucibles. French crucibles. Belgian crucibles.* Graphite, black-lead, or plumbago crucibles. Lining crucibles with carbon. Furnaces.—Sefström's blast furnace. *Deville's blast furnace.* Fire Bricks, &c.—Stourbridge firebrick. Dinas fire-brick. Sand and sandstones.

Fuel.

The calorific power of fuel. Berthier's process of estimating the calorific power of fuel. The calorific intensity of fuel, and theoretical computation. Wood.—Kinds of wood employed as fuel. Elementary composition of dry wood. Proportion of water in wood. Specific gravity of wood. Proportion and approximate composition of the ashes of wood. The rapidity of growth of wood. Weight of wood. Cutting and storing of wood intended as fuel. Peat or Turf.—Specific gravity of peat. Composition of peat. Approximate composition of the ashes of peat. *Proximate composition of peat.* Extraction and desiccation of

peat. Coal.—Definition of coal. Approximate composition of the ashes of coal. Lignites. *Classification of lignites according to external characters.* Approximate composition of lignites. Bituminous coals. Caking coal. Free burning coal. Cannel coal. Anthracite. *Fibrous and granular matter in coals.* Composition of bituminous coals to be given generally and approximately for each class. *The occurrence of certain metals in peat and coals. Frémy's chemical researches on combustible minerals.* Charcoal.—*Specific heat* and specific gravity of charcoal. Proximate composition of charcoal. Various modes of charcoal burning. Charcoal burning in piles or stacks. *Chinese methods of charring in pits.* Yield of charcoal by volume and by weight. Influence of temperature upon yield. *Theory of charcoal burning in circular and rectangular piles.* Peat charcoal or coke. *Carbonization by superheated steam.* Coke.—Properties of coke. Approximate composition of coke. Presence of water in coke. General principles concerning the preparation of coke. Coking in circular piles, in long piles or ridges, and in large open rectangular kilns. Coke ovens. *Cox's coke oven. Coke oven of the Brothers Appolt. Composition and economic application of the waste gases of coke ovens. Davis' Breezeoven. Mineral charcoal.* Coking of non-caking coal slack by admixture with pitch. *Collection of products of economic value generated during the process of coking.* Desulphurization of coke. Combustible Gases.—Carbonic oxide. Hydrogen. Hydrocarbons.

Comparison of fuels in regard to calorific power. *Calorific power calculated from ultimate composition.*

COPPER.

Physical and chemical properties. Specific heat. *Linear dilatation by heat.* Action of heat. Atomic weight. Action of oxygen. Dioxide; protoxide; dioxide and protoxide of copper heated with silica. *Borates of copper.* Disulphide. Disulphide of copper heated with access of air. Theory of the process of heating disulphide of copper with free access of air, or roasting. Disulphide of copper heated in admixture with dioxide, protoxide, or sulphate of copper. *Dioxide of copper heated with protosulphide of iron and silica. Disulphide of copper exposed to the action of hydrogen and water at high temperatures. Metallic copper exposed to the action of the vapour of water at high temperatures. Disulphide of copper heated with carbon, with iron, with zinc, with lead, with tin, with antimony. Copper heated with tersulphide of antimony. Disulphide of copper heated with nitre, with caustic soda, with carbonate of soda, with baryta or lime, with cyanide of potassium.* Copper and dioxide of copper. Copper and carbon. Overpoled copper. Copper and nitrogen. Copper and phosphorus. Copper and arsenic. Copper and silicon. Specific gravity of copper. *Electric conductivity of copper. Influence of various foreign matters on electric conductivity.*

Ores of Copper.—Physical characters and chemical composition of: Native copper. Red oxide of copper. Black oxide of copper. Green carbonate of copper or malachite. Blue carbonate of copper. Vitreous or grey sulphide of copper. Purple copper ore. Copper pyrites or yellow copper ore. True grey copper ore or fahlerz. Chrysocolla. Atacamite. Copper ores of Cornwall and Devon. *Meaning of the word Standard.*

Assaying of copper ores by dry and wet methods. Comparative results by Cornish and wet methods.

Copper Smelting.—In Reverberatory furnaces: The Welsh Process.—Furnaces employed; calciner, melting furnace. The reactions which occur in the process. Calcination; *composition of the gaseous products which escape from the ore-calciner.* Melting of the calcined ore; external

characters, and composition of coarse metal and ore-furnace slag. *Specific gravity of the coarse metal and ore-furnace slag.* Calcination of the granulated coarse metal; Melting of calcined granulated coarse metal; white metal, blue metal, metal-slag. Moss-copper. Roasting; blister-copper, roaster-slag. *Best selected process.* Refining. *Elimination of the following Foreign Metals during the Welsh Process of Copper Smelting.—Arsenic, antimony, tin, nickel, cobalt, gold, and silver. Various proposed improvements in Copper Smelting Furnaces. Napier's process. Method of smelting proposed by MM. Rivot and Phillips. Smelting rich copper slags in a blast furnace.* In Blast Furnaces: In Japan. In Sweden.—Furnaces employed; ore-furnace, black copper furnace, refining-hearth. The processes of roasting or calcination, fusion of the roasted ore, roasting of the regulus from the last operation, fusion for black copper, refining, and toughening. Copper rain. Loss in smelting. *Smelting of copper schist in Prussian Saxony. Copper smelting in Perm in Russia. Cupriferous pig iron. Theory of the process. Kernel-roasting at Agordo.—Composition of the ore. Roasting. Styrian kilns. Mode of charging. Changes which the ore undergoes during roasting. Theory of the process. Wet methods of extracting copper:—Precipitation of copper from solution by iron. Bankart's process. Wet process by M. Escalle. Hähner's patent.*

Loss of copper. Impurities occurring in commercial copper.

Zinc or Spelter.

Physical and *chemical* properties. Atomic weight. Action of oxygen. Action of water on zinc. Oxide of zinc. Reduction of oxide of zinc by carbon, carbonic oxide, and hydrogen. *Silicates of zinc. Reduction of silicate of zinc by carbon. Oxide of zinc heated with boracic acid.* Sulphide of zinc heated with access of air, with oxide of zinc, *with carbon, with various metals, in the vapour of water, with carbonic acid,* with nitre or nitrate of soda, with carbonate of potass or soda, *with lime.* Zinc and phosphorus. Zinc and arsenic.

Ores of Zinc.—Physical character and chemical composition of: Calamine. Electric calamine. Blende. *Red zinc ore.*

Methods of assaying Ores of Zinc.

Methods of Extracting Zinc.—*English Process.—Roasting or calcination of the blende. Pots and condensing tubes. Reduction house. Mode of making the pots. Mode of charging the pots, and management of the furnace. Treatment of the rough zinc.* Silesian Process.—Retorts and appendages. Clay nozzles or condensers. Laggins or stoppers. Iron appendages. Description of the furnace. Calciner. Distillation of zinc. Melting of distilled zinc. Belgian Process.—Retorts and appendages. Description of the furnace. *Carinthian Method. Zinc fume. Montefiori furnace.* Foreign matter in commercial zinc. *Proposed improvements in the extraction of zinc.*

Brass.—Definition. Malleability. Process of stamping. Dead-dipping. Physical properties of various alloys of copper and zinc. Manufacture of calamine brass. Direct preparation of brass. Muntz's metal. Defects occurring in brass. Colouring and lacquering.

Iron.

Physical and Chemical Properties. Magnetism. Tenacity or tensile strength. Specific heat. *Dilatation by Heat.* Action of heat. Welding. "Burnt Iron." Crystalline and fibrous iron. Effect of cold hammering upon iron. Atomic weight. Iron and oxygen.—Protoxide; sesquioxide or red oxide; hydrated sesquioxide; magnetic oxide; iron scale, or hammer slag. *Ferric Acid.* Iron and Water.—Preservation of iron from rust. Iron and Sulphur.—*Disulphide;* protosulphide; *protosulphide exposed to the action of vapour of water at a high tem-*

perature. Protosulphide of iron heated with carbon, with sesquioxide of iron, with sulphate of protoxide of sesquioxide of iron, with protoxide of lead, with other metallic sulphides, with silica, with silica and carbon. Sesquisulphide; bisulphide; or iron pyrites. Magnetic pyrites. Sulphate of protoxide of iron, copperas, or green vitriol. *Neutral tersulphate of sesquioxide of iron.* Sulphides of iron roasted with access of air. Iron and Nitrogen.—Results of experiments. *Passivity of iron.* Iron and Phosphorus.—Phosphides of iron. *On the action of carbon on iron containing phosphorus.* Phosphate of protoxide of iron. Phosphate of sesquioxide of iron. *On the action of iron at a high temperature upon phosphate of lime in the presence of carbon.* Ditto in the presence of carbon and free silica. *On the action of phosphorus on iron containing sulphur. Iron and Arsenic. Case-hardening of iron or steel by arsenic.* Silicon. *Silicon and nitrogen.* Manganese and Silicon. Iron and Silicon.—Reduction of silica by carbon in the presence of oxide of iron and other bases. Protoxide of iron and silica. Reduction of silicate of protoxide of iron by carbon. *Silicate of sesquioxide of iron. Tribasic silicate of protoxide of iron heated with access of air. Liquation of silicate of protoxide of iron containing phosphorus. Protoxide of iron and boracic acid. Sesquioxide of iron and boracic acid.* Iron and Carbon.—Modes of effecting the combination of carbon with iron. Cementation. *Action of carbonic oxide upon iron. Action of solid carbon upon iron. In an atmosphere of carbonic oxide. In an atmosphere of hydrogen.* Amount of carbon in iron. Maximum amount of carbon capable of being taken up by pure iron. *Iron, manganese, and carbon.* Modes of existence of carbon in iron, grey, white, and mottled cast iron. Chill-casting. Spiegeleisen, or specular cast iron. *Action of silicon and of sulphur on iron containing carbon. Abstraction of silicon from cast iron by fusion with sesquioxide of iron alone, and with the addition of manganese.* Carbonate of protoxide of iron. *Action of dilute sulphuric or hydrochloric acid on white and grey cast iron.* Action of sea water on cast iron.

Alloys of Iron.—Iron and copper. Iron and zinc. Process of zincing or galvanizing iron. Iron, copper, and zinc. Keir's patent. *Aich-metal. Sterro-metal.* Iron and tin. *Hardening the tops of rails with tin. Stirling's patent. Action of tin on cast iron.* Iron and manganese; *titanium; lead; bismuth; nickel; cobalt; mercury; silver; gold; platinum; rhodium; aluminium; chromium; tungsten.*

Ores of Iron.—Physical properties and chemical composition of:—Magnetic oxide of iron, magnetite. *Franklinite.* Red hæmatite, red ore or anhydrous sesquioxide of iron. Brown hæmatite, brown iron ore, or hydrated sesquioxide of iron. Spathic carbonate, or sparry iron ore. Argillacious iron ores, clay or clayband ironstones.

Assaying of iron ores by dry and wet methods.

Direct Extraction of Iron in the Malleable State from the Ore.—Iron Smelting in India, Burma, Borneo, Africa, and Madagascar. Catalan Process; trompe, or blowing machine. *Its advantages and disadvantages.* Water wheel, hammer, and anvil. *Theory of the process. Conditions affecting the quality of the iron produced.* Characters of the iron produced. *The Osmund furnace.* Stückhofen or High Bloomery Furnace. *Clay's process. Renton's process. Chenot's process.* Indirect Extraction of Iron in the State of Cast Iron from the Ore.—*Swedish charcoal blast furnace; mine kiln. Pressure of the blast. Temperature of the blast. Iron ores employed. Most important iron mines in Sweden. Smelting of lake and bog iron ores in Sweden.* Description of the modern blast furnace; foundation, hearth, twyer openings, twyer, tunnel head, bracing, blast main, and blast pipes, *blast engines.* Cinder tubs. *Chemical phenomena of the modern blast furnace.* Hot Blast.—Neilson's

patent. When first put into operation. Apparatus for heating the blast. *Neilson's first apparatus. Cast-iron tubular oven.* Syphon pipe, *box-foot pipe, spiral pipe, and pipe-within-pipe oven. Gas oven. Round or oval oven. Theory of the hot blast.* Saving of fuel. *Water-twyers.* The Gases of Iron-smelting Blast Furnaces.—Composition of the gases of the Furnace. *Production of cyanogen in the blast furnace. Temperature of the blast furnace at different depths.* Utilization of the gases escaping from blast furnaces. "The waste gas." Modes of taking off the gases with open-mouthed and with close-mouthed furnaces. *Solid matter carried over with the waste gas.* The best form of the blast furnace. Decrease in volume which the materials undergo during their descent. Elliptical furnace. *Rectangular or Rachette furnace. Blowing in a blast furnace.* Tapping. Sand-bed for casting. Derangements in the working, scaffolding, and slips. Loss of iron in the slag. *Indications afforded by colour of slags. Spontaneous disintegration. Potash in slags. Accidental products of blast furnaces. Silica. Furnace cadmia or calamine. Cyanonitride of titanium. Graphite or kish.* Reduction of phosphoric acid in the blast furnace, and passage of the phosphorus into the pig iron. Economical application of blast furnace slags. *Effects of long continued heat upon sandstone in the hearth bottom. Substitution of lime for limestone as a flux. Application of chloride of sodium.* Explosions in blast furnaces. Poisoning by gas accidentally escaping from blast furnaces. Yields of blast furnaces.

Various kinds of Pig Iron.—Spiegeleisen. Pig iron made from magnetic iron ore. Do. from red hæmatite. *Do. from brown hæmatite. Pig iron produced exclusively from Northamptonshire ore.* Do. wholly or chiefly from argillaceous iron ore of the coal measures. *Yorkshire. Derbyshire. South Staffordshire. North Staffordshire. South Wales. Do. from Cleveland ore. Titaniferous pig iron.*

Production of Malleable Iron from Cast Iron.—South Welsh process; the hollow fire. Swedish Lancashire Hearth; *Walloon process, as conducted in Sweden. Carinthian process.* Slags or cinders produced in finery processes. Running out fire or refinery; composition of refined iron; do. refinery slags or cinders. Puddling; puddling furnace. Invention of iron bottoms; manipulation; theory of the process; composition of tap cinder; invention of the boiling process; double puddling furnaces. *Mechanical puddling. Application of waste blast furnace gas to puddling. Siemens' gas puddling furnace; principle of the furnace. The gas producers. Construction. Puddling with dried wood. Stamping and assorting puddled balls. Utilization of the waste heat of puddling furnaces.* Working of the Ball.—Forge hammers; tilt hammers. Helves or lift hammers. *Steam forge hammers; Nasmyth's. Condie's.* Squeezers; crocodile. Horizontal rotary. Vertical rotary. *Brown's shingling machine.* Puddling or puddle rolls. *Composition of puddled bars.* Working of the Puddled Bar into Merchant or Finished Iron.—Reheating furnace; with coal as fuel. With gaseous fuel, or gas-welding furnace. Piling. Accidents in rolling mills. *Yield of puddled and finished iron.* Manufacture of rails. *Composition of the cinder from the reheating furnace.*

Varieties of Sheet Iron and Slit Rods.—Tin plates. Charcoal plates. *Coke plates. Belgian sheets. Russian sheets. Slit rods.* Special Qualities of Iron.—South Yorkshire. Process of manufacture at Lowmoor, Bowling, and Farnley. South Staffordshire. *Swedish iron. Dannemora. Russian iron.* Boat plates. *Armour plates; rolled; hammered. Mending broken rolls.*

Permanent expansion of cast iron by exposure to long continued heat at or above redness. Dilatation of cast iron by heat.

Production of Steel.—By the Addition of Carbon to Malleable Iron: In the direct reduction of iron ores at one operation. In the Catalan

process. In crucibles. In converting furnaces. Carburization of iron as a distinct process; carburization of pulverulent iron. *Chenot's process.* Carburization of bar iron. Converting furnace. *Carburization by gaseous compounds of carbon.* Carburization by fusing compact iron with carbonaceous matter; *Hindoo process. Wootz. Mushet's steel.* By the partial Decarburization of Cast Iron:—By fusing in hearths. *By puddling.* Composition of puddled steel. *Uchatius process.* By cementation. By Fusion of Pig Iron with Malleable Iron:—*Immersion of malleable iron in molten cast iron.* By Blowing Atmospheric Air through Molten Pig Iron.—Bessemer process. Description of the apparatus. *Parry's process of manufacturing iron and steel.* Casting of Steel.—Furnaces and crucibles. Fusion of steel in the reverberatory furnace. *The addition of manganese in the casting of steel.* Manipulation of Steel.—Hardening and tempering steel. *Metallic baths for the use of working cutlers.* Theory of hardening and tempering steel. Hammering steel. Welding steel. Shear steel. *Casting steel on wrought iron. Damaskeening.*

LEAD.

Physical and Chemical Properties. *Dilatation by heat. Conductivity for heat and electricity.* Action of heat. Autogenous soldering. Action of air, of water, *of carbonic acid, of dioxide of copper, and of acids upon lead.* Protoxide; mode of formation by dry and *wet* methods. Physical characters of massicot and litharge. Action of heat. Action of carbon, *of hydrogen, and of carbonic oxide.* Fusibility with metallic oxides. *Action of metals when heated with protoxide of lead. Dioxide;* Binoxide; mode of formation. *Sesquioxide;* Red lead. Physical and *chemical* properties. Action of heat. *Action of acids.* Sulphide; Silicates of Protoxide of lead. Methods of formation. Fusibility. Action of carbon, of sulphur, *of sulphide of iron*, of iron, *of lime, of lime and carbon,* of peroxide of iron and carbon upon silicates of protoxide of lead. *Silicates of protoxide of lead and potash. Silicates of protoxide of lead and lime. Silicates of protoxide of lead, lime, and alumina.* Physical and chemical properties. Action of heat and air upon sulphide of lead; in the presence of iron pyrites and of blende. *Action of hydrogen and of steam upon sulphide of lead.* Action of protoxide of lead, silicates of protoxide of lead, *of alkalies, of carbonate of soda,* of cyanide of potassium, of alkalies and alkaline carbonates and carbon, of lime and carbon, *of peroxide of iron and carbon,* of nitrate of potash, *of chloride of sodium,* of iron, *of tin,* and *of copper* when heated with sulphide of lead. Combination of sulphide of lead with other sulphides. *Subsulphides of lead.* Sulphate; physical and *chemical* properties. Action of heat. Action of carbon, of iron, of lead, of protoxide of lead, of sulphide of lead, *of chloride of lead,* of silica, of lime, of *chloride of sodium,* and of cyanide of potassium, upon sulphate of lead. *Sulphate of lead and fluor spar.* Lead and Phosphorus. Phosphide; phosphates. Lead and Arsenic. Action of arsenious acid on lead. Arseniate of lead. Carbonate; white lead.

Alloys of Lead.—Lead and antimony; zinc; *copper; mercury; gold;* silver.

Ores of Lead.—Physical character and chemical composition of: Galena or sulphide of lead. Cerussite, or carbonate of protoxide of lead. Anglesite or sulphate of protoxide of lead. Pyromorphite or phosphate of protoxide of lead. Mimetisite or arseniate of protoxide of lead. Minerals occurring with galena.

Methods of assaying Lead Ores.

Extraction of Silver from Lead.—Pattinson's process.—*Theory of the process,* methods of working, description of the apparatus and me-

chanical appliances. *Limit of concentration. Effect of foreign metals.* Parkes' process.—Methods of working. *Principles involved.* English process of cupellation.—Construction of furnace, mode of conducting the process, nature of the products, *chemical composition of the products and chemical reactions involved.* German process of cupellation (abtreiben).—Description of furnace, mode of conducting the process, nature of the products and *chemical composition of products.* Refining of "Blicksilber."—In open test. Under a muffle.

Extraction of Lead from the Ore.—Air-reduction process: Flintshire furnace.—Description of the furnace, process, peculiarities, nature of the products, *chemical composition of the products and chemical reactions which occur. Action of lime.* Derbyshire furnace.—Description of the furnaces, process, nature *and composition* of the products. Brittany furnace.—Process. Belgian Flintshire furnace.—Description. Spanish reverberatory furnace.—Description of and mode of working. Cornish process.—Description of "calciner" and of "flowing furnace" process. Nature of the products. *Chemical composition of the products. Action of iron.* Bleiberg process.—Peculiarities of the process, character of the furnace, and method of working. Nature of the products. *Chemical composition of products. Modifications of the process.* Peruvian furnace.—Description of and mode of working. Ore hearth.—Construction of the furnace, method of working, and nature of the products. *Chemical composition of the products and chemical reactions which occur in the process. American ore hearth. Peculiarity. Advantages. Indian method in blast furnaces.* Roasting and deoxidizing process: Swedish process.—Nature of the ores, description of the furnace, mode of working, and nature of the products. Freiberg process.—Nature and classification of the ores, description of the furnaces, method of working, and nature of the products. *Accessory products. Composition of the products and chemical reactions involved.* Pontgibaud process.—Description of the ore, roasting and blast furnaces, mode of working, and nature of the products. *Chemical reactions involved.* Smelting of the ores of Commern.—Description of the ore, furnaces, methods of working, nature of the products. *Chemical reactions involved.* Iron reduction process. Tarnowitz process.—Description of the low furnace and method of proceeding. Upper Harz process.—Method of working, nature of the products. *Chemical principles involved. Japan method with iron.* German method with basic silicate of protoxide of iron.—Description of the Rachette furnace.

Condensation of Lead Fumes.—Description of the various methods and apparatus employed. Physical characters *and chemical composition* of lead fume. Treatment of lead fume.

Softening of Hard Lead.—By atmospheric oxidation. Description of the furnace, method of working, and nature of the products. By special agents of oxidation: methods of proceedings. Treatment of the dross. Liquation of hard lead.

Reduction of Litharge.—Methods of proceeding with reverberatory, Bleiberg, blast, and German cupellation furnaces. *Chinese method.*

Manufacture of Red Lead.—General principles involved. Description of the drossing and colouring ovens. Methods of working and nature of the products. Drossing by machinery. *Chemical principles involved.*

Miscellaneous Details.—Varieties of lead in commerce. Impurities occurring in lead. *Methods of testing for metals present in lead. Cast sheet lead.* Milled sheet lead. Lead suitable for pipes, sulphuric acid chambers. Red lead and white lead. Purchase of ores. Cost of smelting, Poisoning by lead.—Symptoms of poisoning. Preventive measures.

Silver.

Physical and chemical properties. *Dilatation by heat. Conductivity for heat and electricity. Specific heat.* Action of heat, of heat and air, of nitre, *of chloride of sodium, of oxide of copper,* of protoxide of lead, *of sulphate of protoxide of copper,* and of acids upon silver. Silver and Oxygen. Protoxide; physical and chemical properties. Methods of producing. Action of heat. Action of carbon. *Action of chlorine.* Silver and Sulphur. Sulphide; physical and chemical properties. Modes of formation. Action of heat. Action of heat and air. Action of heat and air in the presence of iron pyrites, copper pyrites, *disulphide of copper, blende, and galena. Action of hydrogen, of steam,* of acids, of nitre, of iron, of lead, *of copper, and of mercury upon sulphide of silver.* Combination with other sulphides. *"Oxidized silver" process.* Sulphate; physical and chemical properties. Mode of producing. Action of heat. Action of chloride of sodium. Mode of formation of compound of sulphide and sulphate of silver. *Solubility in water. Sulphite;* hyposulphite; method of preparation. *Action of hydrochloric acid upon.* Action of hyposulphite of soda on chloride of silver. Nitrate; physical and chemical properties. Action of heat. Method of separation from nitrate of protoxide of copper. *Action of carbon and phosphorus upon solutions of.* Silver and Chlorine. Chloride; physical and chemical properties. Methods of formation by dry and wet processes. Methods of reduction by carbonate of soda, by carbonate of lime, by zinc. *Action of hydrogen,* of acids, of chloride of sodium, *of cyanide of potassium,* of iron, lead, *copper, tin, antimony, arsenic, mercury,* of sulphur, of metallic sulphides, and of protoxide of lead upon chloride of silver. *Silver and bromine. Silver and iodine. Silver and phosphorus. Silver and arsenic.*

Alloys of Silver.—Silver and lead; copper; gold; *zinc; palladium; antimony.*

Ores of Silver.—Physical characters and chemical composition of: Native silver. Silver glance or sulphide of silver. Sulphide of silver and copper. Antimonial silver. Ruby silver or sulphide of silver and antimony. Brittle silver glance. Sulphide of silver and arsenic. Polybasite. Sulphide of silver, antimony, and lead. Horn silver or chloride of silver. *Bromide of silver. Iodide of silver. Nature of metalliferous minerals containing silver.*

Assaying of ores and alloys of silver by the dry and wet methods.

Methods of Extraction.—Extraction of silver from argentiferous copper: Liquation process, or "Saigerarbeit."—Description of furnace. Mode of operation. Nature of the products. *Chemical principles involved.* Extraction of silver from the ore: Mexican amalgamation process.—Apparatus employed, materials used, method of working, nature of the products and *chemical principles involved. Specialties of the process.* Working of the silver amalgam. *Application of copper amalgam. Loss of silver in the process. Chloride of silver process.* Freiberg amalgamation process.—Description of furnaces and apparatus, Mode of working and *chemical principles involved. Composition of silver amalgam.* Method of separating the silver from the amalgam. *Amalgamation of argentiferous speise. Amalgamation of argentiferous copper regulus.* Extraction of silver from argentiferous regulus: Ziervogel's process.—Description of the furnaces and apparatus employed, method of operation, nature of the products, and *chemical reactions involved in the various operations. Specialties of the process.* Augustin's process.—Description of the process and *chemical principles involved.* Von Patera's method.—Apparatus used, materials employed, products obtained, and *chemical reactions in the process.* Extraction of silver from ore by means of lead: Furnaces used, method of working, nature of the

products. *Chemical composition of the products and chemical reactions involved*. Methods of plating or silvering: Old methods. On copper. On steel. Method of silvering without the use of "batteries." *Stripping of silver plate.*

Varieties of silver in commerce. Metals occurring in silver. *Methods of testing silver for foreign metals.*

Gold.

Physical and chemical properties. Dilatation by heat. *Conductivity for heat and electricity*. Action of heat. *Protoxide; physical properties, mode of preparation, action of hydrochloric acid.* Teroxide; physical and chemical properties. Protosulphide; methods of formation, physical characters. Tersulphide; mode of producing, physical characters, action of heat, *of chlorine, of hyposulphite of soda, and of potash upon tersulphide of gold. Gold and phosphorus. Gold and arsenic.* Gold and chlorine; *protochloride;* terchloride; methods of formation. Action of oxalic acid, of sulphate of protoxide of iron, *of terchloride of antimony and of chloride of arsenic* on solutions of chloride of gold. *Preparation of purple of Cassius. Method of colouring "ruby glass."*

Alloys of gold.—Gold and copper; *zinc;* silver; lead; *tin; antimony; iridium; platinum; palladium;* copper and zinc; silver and copper.

Use of the touchstone. Definition of the terms "standard" and "carat."

Ores of Gold.—Native gold; physical character and chemical composition. *Various metalliferous minerals containing gold.* Auriferous quartz.

Assaying of ores and alloys of gold by dry and wet methods.

Methods of Extraction.—Amalgamation of quartz containing gold; apparatus employed, mode of working, nature of the products, and method of extracting the gold from the amalgam. *Longmaid's process. Anossow's process by means of iron. Plattner's process by chlorine.* Melting of gold dust. Sweep refining.

Separation of Gold from Silver and Copper. Parting.—Dry methods: *By litharge and sulphur.* By cementation; description of the process. *Chemical reactions involved. By sulphur.* Wet methods: Nitric acid process; apparatus used, method of working, and *chemical principles involved.* Sulphuric acid process; apparatus employed, mode of working, and *chemical reactions involved. Modifications of the process. Refining gold containing silver by chlorine.*

Varieties of Gold in Commerce. *Methods of detecting copper, silver, lead, tin, antimony, platinum, palladium, and iridium in gold.*

Mercury or Quicksilver.

Physical and chemical properties. Action of heat, of air, *of acids, and of chlorine upon mercury. Suboxide; physical and chemical properties.* Protoxide or red oxide; mode of formation, physical and *chemical* properties. Action of heat. *Subsulphide; physical and chemical properties.* Protosulphide or vermilion; methods of preparation, physical and *chemical* properties. Action of heat, of heat and air, *of hydrogen,* of iron, of lime, *of alkalies, of chlorine, and of acids upon protosulphide.* Subchloride; physical and *chemical* properties. Protochloride; physical and *chemical* properties.

Amalgams.—Mercury and silver; gold; copper; *iron;* sodium.

Ores of Mercury.—Physical characters and *chemical composition* of: Native mercury. Cinnabar. *Native amalgan. Fahlore containing mercury. Nature of other minerals containing mercury.*

Methods of assaying of ores of mercury.

Methods of Extraction.—Description of furnace, method of operation, nature of the products, and *chemical reactions involved* in the following

methods: *Huanacavelica process. Almaden process. Idrian process.* Leopold furnace process. Alberti process. Hähner's furnace process. *Gallery furnace process. Fahlore process.*

Impurities present in mercury. Methods of testing mercury for foreign metals. Modes of purifying commercial varieties of mercury. Water gilding.

Cobalt.

Physical and *chemical* properties of the metal. Methods of preparation. Protoxide; mode of formation, physical and *chemical* properties. *Action of hydrogen.* Sesquioxide; methods of preparation, physical and *chemical* properties. *Action of carbon.* Physical and *chemical* properties and mode of producing the compounds of cobalt and arsenic. *Arseniate of cobalt.*

Ores of Cobalt.—Physical character and *chemical composition* of: Cobalt glance. Smaltine. *Cobalt bloom. Nature of other minerals containing cobalt.*

Methods of estimating cobalt.

Cobalt products.—Smalts; mode of preparation. Apparatus used. Nature of the products. *Chemical composition of the products. Chemical principles involved* in the manufacture. Uses of smalts and oxide of cobalt. Silicate of protoxide of cobalt; mode of obtaining. Physical characters. *Rinmann's green; mode of preparation. Nature of. Chemical composition. Thenard's blue; mode of preparation. Nature of. Chemical composition. Phosphate of cobalt.* Printers' blue; application. Mode of preparation. Nature of. *Chemical composition.*

Nickel.

Physical and *chemical* properties of the metal. Physical and *chemical* properties of protoxide and peroxide of nickel. *Action of hydrogen. Action of carbon.* Physical and *chemical* properties and mode of obtaining compounds of nickel and sulphur. Physical and *chemical* properties of the compounds of nickel and arsenic. Nickel speise; *chemical composition. Pottery nickel. Action of heat and air upon arsenide of iron, cobalt, and nickel.*

Alloys of Nickel.—German silver; mode of preparation, physical characters and composition of the commercial varieties. *Nature and composition of other alloys containing nickel.*

Ores of Nickel.—Physical characters and *chemical composition* of: Kupfernickel. Nickeliferous pyrites. Arsenical nickel. Nickel glance. *Millerite. Nature of other minerals containing nickel. Meteoric iron.*

Methods of assaying nickel ores.

Methods of Extraction.—Apparatus employed, mode of working, nature of the products, and *chemical reactions involved.*

Commercial varieties of nickel. *Foreign metals occurring in nickel.*

Arsenic.

Physical and *chemical* properties. Action of heat, and of heat and air upon the metal. Physical and *chemical* properties, and methods of preparation of the compounds of arsenic and oxygen. *Action of light.* Action of heat. Action of carbon, of *hydrogen,* and of *carbonic oxide upon arsenious acid.* Physical and *chemical* properties, and methods of obtaining the compounds of arsenic and sulphur. Action of heat, *of carbonate of soda and carbon, and of cyanide of potassium upon the sulphides of arsenic.*

Ores of Arsenic.—Physical characters and *chemical composition* of: Native arsenic. Realgar. Orpiment. Mispickel. Arsenical iron pyrites. *Nature of other minerals containing arsenic.*

Methods of estimating arsenic.

Methods used for obtaining White Arsenic.—Description of apparatus, methods of working, nature of the products and *chemical reactions involved.* Methods of refining white arsenic; description of apparatus, mode of working, and nature of products. *Preparation and chemical composition of yellow arsenic glass. Preparation and chemical composition of red arsenic glass.* Preparation of metallic arsenic.

Applications of arsenic and its various compounds. Nature and *chemical composition* of Emerald Green and *Scheele's green. Opalescent glass. Mode of producing Green bronze.*

ANTIMONY.

Physical and *chemical* properties of the metal. Physical and *chemical* properties, and methods of formation of the following oxides of antimony:—Teroxide; action of carbon, *of cyanide of potassium,* and of sulphur, upon teroxide of antimony. Intermediate oxide. Antimonic acid; action of heat. Tersulphide; methods of formation. Physical and *chemical* properties. Action of heat, of heat and air, *of steam,* of carbon, of *carbonic oxide,* of cyanide of potassium, of nitre, of iron, of *copper,* of *tin,* and *of acids* upon tersulphide of antimony. Glass of antimony. Liver of antimony.

Alloys of Antimony.—Antimony and lead. Action of heat and air upon alloys of antimony and lead. *Antimoniates of protoxide of lead. Naples yellow.* Composition of type metal and stereotype metal. *Antimony and iron; copper; "Regulus venus"* tin. *Other alloys containing antimony used in the arts.*

Ores of Antimony.—Physical characters and *chemical composition of: Native antimony.* Antimony glance. Valentinite. Antimony ochre. *Red antimony ore. Nature of other minerals containing antimony.*

Assaying of ores of antimony.

Methods of Extraction.—Apparatus used, methods of working, nature of the products, *Chemical composition of the products,* and *chemical reactions involved* in the following methods:—Liquation process. Reduction by iron, English process. French method.

Foreign metals occurring in antimony. Methods of testing for foreign metals.

TIN.

Physical and *chemical* properties of the metal. Action of heat, of air, of heat and air, and *of acids* upon the metal. *Action of tin on various metallic oxides.* Physical and *chemical* properties of the following:—Protoxide; *Sesquioxide;* Binoxide; *"Putty powder." Stannate of soda.* Physical and *chemical* properties of the following:—Protosulphide *Persulphide; Protochloride; Perchloride.* Tin and Arsenic.

Alloys of Tin.—Tin and copper. Physical properties and composition of bronze, Bell metal, and Speculum metal. Casting of Bronze. Tin and antimony. Britannia metal. *Tin and zinc.* Tin and lead. Pewter. Solder. Soldering. *Tin, lead, and copper. Roman pot metal. Other alloys employed containing tin. Bearing metal. Amalgam for electrical machines. Tin bronze. Tinning of brass pins.*

Ores of Tin.—Nature and *chemical composition* of Cassiterite. "Stream tin." "Mine tin." "Wood tin." *Tin pyrites or bell-metal ore. Minerals occurring with tin ores.*

Assaying of tin ores.

Smelting of Tin Ores.—In reverberatory and blast furnaces.—Description of furnaces used, methods of working, nature of the products, *chemical composition of the products, and chemical reactions involved.* Refining of tin. *Oxland's process.*

Commercial Varieties of Tin.—Common tin. Refined tin. Grain tin. Block tin. *Foreign metals occurring in tin. Methods of testing for foreign metals.*

Bismuth.

Physical and *chemical* properties. Action of heat, of air, *of steam, and of acids* upon bismuth. Teroxide; mode of formation. Physical and *chemical* properties. Action of carbon. *Protoxide.* Tersulphide; methods of formation. Physical and *chemical* properties. Action of heat. *Action of hydrogen. Action of metals when heated with Tersulphide of Bismuth.*

Alloys of Bismuth.—Nature and composition of alloys containing bismuth employed.

Ores of Bismuth.—Names of various minerals containing bismuth. *Physical characters and chemical composition of minerals containing bismuth.*

Methods of estimating bismuth.

Methods of Extraction.—Apparatus used. Description of processes, *and chemical actions involved in the various methods. Old methods.* Recent methods. Plattner's furnace.

Foreign metals occurring in bismuth. Methods of testing for foreign metals.

Platinum.

Physical and *chemical* properties of the metal. *The properties of Platinum black and Spongy platinum, and methods of formation.*

Ores of Platinum.—Native platinum. Physical characters. *Metals occurring in. Minerals associated with.*

Methods of Extraction.—Wet method. Deville's method. Melting of platinum. *Working of platinum.*

SUBJECT XX.—NAVIGATION.

First Stage or Elementary Course.

General Notions.—Figure of the earth; earth's diameter, axis, poles. Meridians; equator, equinoctial. Parallels of latitude; latitude, longitude. Difference of latitude; difference of longitude. Rhumb line; course; nautical distance, meridian distance; departure.

Examples of differences of latitude and longitude. The meridian distance is equal to the difference of longitude multiplied by cosine of latitude. When a ship is sailing on a parallel of latitude:— (1), given the distance made good and latitude to find the difference of longitude; (2), given the difference of longitude and the latitude to find the distance; (3), given the meridian distance and the difference of longitude to find the latitude.

The Compass.—Description; Points. Number of degrees, minutes, and seconds in a point, ¼ point, ½ point, ¾ point. To reduce points and parts of points into degrees, minutes, and seconds, and conversely.

Variation of the Compass: easterly, westerly. How to be allowed (1) when it is required to find the true from compass course; (2), to find compass course from true.

Causes of Local Deviation.—How the amount of local deviation is ascertained practically; how allowed. Examples of correction of courses for variation and deviation.

Leeway.—Definition. Starboard tack, port tack, close-hauled. How leeway is to be allowed. Examples.

The Log.—Description. How divided.

Plane Sailing.—Construction of figures. Proof of formulæ used in plane sailing, viz., connecting nautical distance, difference of latitude, departure and course. Examples.

Traverse Sailing.—Definition of a traverse. To resolve a traverse. Construction of traverse table. Examples.

Middle Latitude Sailing.—To prove the formulæ used. Examples.

SECOND STAGE OR ADVANCED COURSE.

Mercator's Projection and Chart.—Description. How meridians are laid down, and divided for representation of the latitudes. Chief value of the chart is :—"That the angle which a straight line joining any two "places on a chart makes with the meridians is equal to that which the "rhumb line joining the same two places on the globe makes with the "meridians": proof of this.

To draw a Mercator's chart. To find the latitude and longitude of any place on the chart, and *vice versâ*, from the latitude and longitude to find its place on the chart. To find the course between two places on the chart. To find the ship's place by the bearing of two known places or headlands. To lay down a rock, island, or headland from observed bearings. To find the distance between two places on the chart. From the course and distance run to find the place on the chart.

Proofs of rules used in Mercator's sailing. Examples.

Local Deviation.—More accurate account of the causes of sub-permanent and induced magnetism. Laws of induced magnetism in a ship. Semicircular and quadrantal deviation. Description of modes for ascertaining the amount of deviation.

Great Circle Sailing.—Given the latitude and longitude of two places to find the distance between them on a great circle. To find also the latitude and longitude of the vertex. To find a succession of points on a great circle between two places. Examples.

Errors to which the log is liable. Having given the apparent distance run with given known errors in log line and glass, to find the true distance.

To find the difference of longitude made on a traverse. Sea journal. Taking a departure. Log-board and log-book. Day's work. Examples.

EXAMINATION FOR HONOURS.

In addition to the above there will be required—

The proof of the rule for finding meridional parts, viz.:—

$$m = 3{\cdot}8988495 + \log.\ (\log.\ \cot.\ \tfrac{1}{2}\ \text{colat.} - 10).$$

Problems in Marine Surveying, &c.

TEXT BOOKS.

A Treatise on Navigation and Nautical Astronomy, by J. Riddle (*with Tables*), 2 vols., 11*s.* 6*d.* Tables separate, 5*s.*
(London, Simpkin & Marshall, 8th ed., 1864.)

Navigation and Nautical Astronomy, by H. W. Jeans, in two parts, 12mo., 5*s.* each, or in one vol. 9*s.*
(London, Longman, new ed., 1860.)

Or, *Navigation and Nautical Astronomy*, by Merrifield & Evers.
(London, Longman & Co.)

Nautical Tables for British Seamen, by James Inman, 8vo., 14*s.*
(London, Rivington, 1862.)

For reference the following books may be consulted :—

1. *Navigation and Nautical Astronomy for British Seamen*, by James Inman, 8vo. (London, Rivington.)
2. *Practice of Navigation*, by D. Raper, R.N.
3. *Navigation and Nautical Astronomy*, by — Bowditch. (U.S.America.)
4. *Glossary of Navigation*, by J. B. Harbord, M.A.
(London and Edinburgh, W. Blackwood & Sons.)
Sold by J. D. Potter, Admiralty Chart Agent, London.
5. *Outlines of Astronomy*, Sir J. F. W. Herschell.

SUBJECT XXI.—NAUTICAL ASTRONOMY.

First Stage or Elementary Course.

Definition.—Circles of declination or hour circles. Equinoctial points. Ecliptic, obliquity of ecliptic, signs of the zodiac. Precession of the equinoxes, circles of celestial latitude. Latitude and longitude of a celestial body.

Declination, right ascension, right ascension of the meridian, sensible and rational horizon. Zenith, nadir, vertical or azimuth circles or circles of altitude. Altitude, azimuth, and amplitude of a heavenly body. Parallels of altitude. Six o'clock hour circle. Prime vertical. Colatitude.

Proof that the altitude of the elevated pole is equal to the latitude of the observer. Illustration by diagrams; projections on the meridian and horizon.

Time. Apparent noon, apparent solar day, mean solar day, mean noon, equation of time. Sidereal day. To convert intervals of mean time into sidereal time, and *vice versâ.* Illustration of these definitions by diagrams. Difference between civil and astronomical reckoning of time. To convert arc into time, and time into arc.

To find the Greenwich date, the time at any other place and longitude being given. To take out the right ascension of the mean sun for a given mean Greenwich date.

The corrections of altitudes:—

1. *Dip.*—Proof that dip in minutes$=\cdot 9784\sqrt{h}$, h being reckoned in feet.
2. *Refraction.*—Why necessary? Show generally how it is measured. Refraction $=57''$ tan Z.D nearly.
3. Correction for semi-diameters.
4. *Parallax.*—Horizontal parallax $\times$ cos. apparent altitude $=$ parallax in altitude.

Sextant.—Description. Adjustments, how to make them. Index error, how it may be found.

Chronometer.—Error and rate. Reading of the chronometer.

Equation of time.—How it is to be applied to the mean time to obtain the apparent time, and conversely.

To find the latitude by a meridian altitude of the sun: proof of the rule and examples. To find the latitude by a meridian altitude of a star.

To find the mean time at any place and also the Greenwich mean time of the passage of a star over a given meridian on a given day, and the distance at which it passes north or south of the zenith. To find the latitude by the altitude, (1), of the sun; (2), of a star below the pole. To find the latitude by the altitude of the pole star. To find the variation or local deviation by the observed azimuth or amplitude of the sun. Proof of the rules for finding the azimuth and amplitude. Applications of the rules to find the variation or deviation.

To find the hour angle of a heavenly body east or west of the meridian. To compute the mean or apparent time at any place from the observed altitude of a heavenly body. To find the error and rate of the chronometer. To find the longitude by the chronometer.

Second Stage or Advanced Course.

For the advanced course, in addition to the above, the candidate will be required:—

To find the latitude by the moon:—

1. To find the mean time, and Greenwich date, of the moon's meridian passage on a given astronomical day in a given altitude.
2. To find the semidiameter and horizontal parallax of the moon for a given Greenwich date (mean time) from the Nautical Almanac.

3. To take out the moon's declination from the Nautical Almanac.
4. To find the latitude by the meridian altitude of the moon above and below the pole. Examples.

To compute the reduction of the horizontal parallax.

To define the angle of the vertical, and to describe the method of computing it.

To compute the augmentation of the moon's semi-diameter.

To prove the following rules :—

1. For the reduction of the altitude of any celestial body observed at one place to what it would have been if observed at the same instant at another place.
2. For finding the latitude by the altitude of the pole star.
3. For finding the latitude by altitudes of any celestial body near the meridian.
4. For finding the hour angle of a celestial body from the observed altitude.
5. For finding the rising and setting of celestial bodies and twilight.
6. The error of hour angle for small errors in observed altitude, when least.
7. For finding the latitude and longitude by means of two altitudes.
8. For computing the altitude of a given celestial body for a given time.
9. The method of clearing a lunar distance from the effects of parallax and refraction.

And to work practical examples of all these rules.

To compute the latitude and longitude by double altitudes—1. By Ivory's method. 2. By the direct method.

To find the error of the chronometer by equal altitudes of the sun or of a fixed star. To compute the apparent altitude from the true altitude. To compute the longitude by an observed lunar distance. To describe Summer's method for finding latitude and longitude. Cyclones and tides.

Examination for Honours.

In addition to the above :—

Method of computing the moon's right ascension from an occultation of a fixed star. Longitude by eclipses of Jupiter's satellites. To find the position of an unknown star or comet by its distances from two known stars. Astronomical problems.

Text Books.

For studying this subject the same books may be mentioned as have already been given at the end of the courses on *Navigation.*

SUBJECT XXII.—STEAM.

First Stage or Elementary Course.

In the first paper the questions will be restricted to those portions of the syllabus comprised under the heads numbered 1, 2, and 3, or 1, 2, and 4 respectively, and the students will be expected to possess a fair elementary knowledge of the subject.

Second Stage or Advanced Course.

In the second or advanced paper the questions will bear upon those portions of the syllabus numbered 1, 2, 3, and 5, or 1, 2, 4, and 5 respectively, and a more exact knowledge of details will be expected.

Examination for Honours.

The range of subjects will be the same as in the advanced course, but the questions will extend over that portion comprised under the sixth head of the syllabus.

1. *Introductory Matter.*—The expansion of bodies by heat, the liquid and gaseous states of matter, the co-efficient of expansion, energy of the atomic forces, practical illustrations of the expansion and contraction of various substances; the temperature of bodies, instruments for measuring temperature, the thermometer, comparison of thermometers when differently graduated, pyrometers; the capacity of bodies for heat, the calorimeter; the conversion of work into heat and of heat into work, the consumption of heat in liquefaction and vaporization; the convection of heat, the method in which a large mass of water may become heated; the conduction of heat, good and bad conductors, experimental illustrations; the formation of vapour and steam, the boiling points of fresh and salt water, the causes which influence the boiling temperature of water, high-pressure steam, measure of steam pressure by atmospheres, steam when in contact or not in contact with water, the relation between the pressure, density and temperature of steam, the specific gravity of steam, the latent heat of steam, the quantity of water required to produce condensation, common and superheated steam, the analysis of sea water.

   The radiation of heat, the absorption of heat, the general relation between radiation and absorption, good and bad radiators of heat, experimental illustrations.

   The oxidation of metals, the effects of galvanic action.

2. *Steam Engine.*—Newcomen's atmospheric pumping engine, its defects; the discoveries of Watt, the separate condenser, the expansive working of steam, its economy, its value in regulating the power of an engine.

   Details connected with Watt's single-acting pumping engine; the steam cylinder, the valves connected with it, their action, the condenser, the air-pump, the foot valve, the delivery valve, the snifting valve, the hot well, the piston rod, stuffing boxes and glands, the parallel motion; the method of starting the engine, and of regulating its speed, the cataract.

   The double-acting condensing beam engine, the principle upon which it works; details of the various parts, the cylinder, how constructed, the ports or openings into the cylinder, the forms of slide valve in common use, the locomotive or three-ported valve, the lap on a valve, the eccentric, the lead of a valve, cushioning the steam, clearance, details of the piston, metallic packing-rings; the expansion valve, and the gear connected with it; the air-pump, condenser, the supply of water for condensation, blowing through, gauges for the condenser, the barometer gauge, method of estimating pressure by it, errors in this method, and correction of the same; the connecting rod, the strap gib and cutter, the parallel motion, the governor, the fly-wheel.

   The principle of an equilibrium valve, the double beat valve, the crown valve, the throttle valve, the gridiron valve.

   The high-pressure engine without condensation, the expansive principle as applied in the double cylinder condensing engine.

   The forms of boiler in common use: the Cornish boiler, the cylindrical boiler with internal flues, the vertical boiler, heating and fire-grate surfaces, the evaporative power of boilers, boiler chimneys; the strength of boilers, the use of stays, the proving of boilers. Boiler appendages; safety valves, reverse or atmospheric valves, communication or stop valves, the glass water gauge, steam pressure gauge, various forms, Bourdon's gauge, feed pumps.

3. *The Locomotive Engine.*—The general construction of a locomotive engine and boiler before the invention of Stephenson, the Killingworth engine; description of the Rocket engine by R. Stephenson

as the type of the modern locomotive, the tubular boiler, the draught produced by the discharge of waste steam.

The arrangement of an engine, the cylinders, their position, steamways, ports, slide valve, water cocks, grease cocks, the piston and packing-rings, piston-rod, guides, connecting rod, eccentrics, the reversing or link motion, reversing lever, sector, expansive working, crank axle and driving wheels, power required for traction, adhesion of the driving wheels, counter weights to cranks, wheels and axles, axle-boxes, bearing springs, buffer and draw springs, friction brakes.

Details of the boiler; the fire-box, the inner and outer shell, ribs on the crown of the fire-box, the cylindrical barrel, the tubes, mode of fixing them, through tie rods, the ashpit, the smoke box, the blast pipe, mechanical action of the blast, the steam chest, the outer dome, the steam pipe, the regulator, safety valves, pressure gauges, whistles, blow-off cocks, feed pumps, Giffard's injector; evaporative power of the boiler, fire-grate and heating surface, combustion of fuel; the tender, water-tank, brake, feed pipes.

The permanent way; varieties of rails in common use, timber sleepers, transverse and longitudinal systems; jointing of rails, the fish joint; the tyres of wheels, their form, general description of switches and crossings.

4. *The Marine Steam Engine.*—Side lever engine, the oscillating engine for paddle-wheel steamers, the vertical trunk engine; the Gorgon engines, the object of this arrangement; other forms of engine. Engines for screw propellors, direct acting engines with or without multiplying gear, Penn's trunk engine, Maudslay and Field's return connecting-rod engine.

Details of parts connected with the working of a marine engine; the air pump bucket and valves, double-acting air pump, India-rubber disc valves, cylinder escape valves, bilge and feed pumps, expansion valves, expansion cams and gear. The method of reversing an engine when fitted with a single eccentric, reversing by a double eccentric, the link motion. Paddle wheels, feathering of the floats, disconnexion and immersion of wheels. The screw propeller, various forms, length, angle, pitch, and area of screw blade, disconnecting and raising the screw, the position of the screw propeller in the vessel, the slip of the screw, the method of receiving the thrust upon the vessel, soft metal bearings.

The marine tubular boiler, how constructed, gun-boat boilers, the steam-chest, fire-bridge and ashpit, the funnel and its casing, waste-steam pipe, water gauge, gauge cocks, pressure gauges, safety valves, reverse valves, stop valves, feed pumps, boiler hand-pumps, feed or donkey-engine, Kington's valves, blow-out cocks, brine-pumps and brine-valves, the methods of ascertaining the degree of saltness of the water in a boiler, amount of saltness permissible, formation of scale, superheating apparatus, surface condensation.

Practical working; getting up the steam, filling the boilers, laying the fires, attention to various parts of the engine while the steam is getting up, mode of starting, working the engines at moorings. Priming; its causes and remedies. Duties to machinery when under steam, boilers, fires, &c. Injection pipes. Kingston's valves. Leaks in engines. Bearings of engines. Expansive working. Management of fuel. Damages and repairs to boiler, &c., after accidents. Duties to engine, &c., on arriving in harbour.

5. *Calculations.*—Methods of measuring the efficiency of steam engines. The duty of an engine. The horse power. Mercantile or nominal horse power.

The indicator; the ends it fulfils, description of the instrument,

the atmospheric line. Method of taking a diagram. The general configuration of diagram to be expected under various circumstances. Examination of the indicator-diagram when the steam is throttled; when expansive gear alone used, and in other cases. To ascertain the horse-power of an engine by means of the indicator. The indicator-diagram in a high pressure or locomotive engine.

The principle of the parallel motion of a beam engine.

6. *Calculations.*—Investigation of the work done by the evaporation of water. Estimation of the work done in one stroke of the piston, the same taking clearance into account. To find the horse power from the evaporation in the boiler. De Pambour's theory. Velocity of maximum useful effect. To find the evaporation of a condensing engine of given dimensions and horse power, the piston moving with a given velocity with and without expansion. To find the pressure in the cylinder, knowing the effective evaporation. To find the diameter of a cylinder to work at a certain speed, knowing the evaporation. To find the evaporation in the boiler, knowing the diameter and velocity of the piston and the pressure of steam in the cylinder with and without expansion. The same for locomotive, Watt's engines, &c.

The screw—to find its area, to find also the angle of the helix or thread of the screw propeller, and the pitch. The power exerted by a screw. How far the slip depends on the form and dimensions of the screw. Motion of the paddle-wheels, &c. Consumption of fuel. Measure of the locomotive performance of marine steam engines. To find the angle the crank has moved through when the piston is at a given distance from the top of the stroke. Amount of work developed by the crank in a half-revolution. Length of the radius-bar in a side lever engine. Work done in the up and down stroke of the air pump. The best temperature for the condenser of a steam engine. Qualities of fuel, &c.

Diagram showing the relative motions of the slide and piston at every point of the stroke.

Dynamometer: to find horse-power of engine by means of it.

Text Books.

The following books may be mentioned :—

Treatise on the Marine Steam Engine, by T. J. Main and T. Brown, 8vo., 12*s*. 6*d*. (London, Longman, 5th ed., 1865.)

On the Indicator and Dynamometer, by T. J. Main and T. Brown, 8vo., 4*s*. 6*d*. (London, Longman, 1857.)

Catechism of the Steam Engine, by J. Bourne, 12mo., 6*s*. (London, Longman, 1868.)

Manual of the Steam Engine, by the Rev. J. A. Galbraith.

And for reference—

Railway Locomotives, by D. K. Clark, 2 vols., folio, 70*s*. (Edinburgh, Blackie, 1856–60.)

Treatise on the Steam Engine, by J. Bourne, 4to., 42*s*. (London, Longman, 5th ed., 1861.)

Examples of Modern Steam, Air, and Gas Engines, by J. Bourne, Part I., 4to., 2*s*. 6*d*. (London, Longman, 1868.)

SUBJECT XXIII.—PHYSICAL GEOGRAPHY.

First Stage or Elementary Course.

For this stage or course it will be expected that the student shall understand and be able to express the simple facts of the science and explain the terms in common use. The following synopsis will be found to include the various branches of the subject required :—

1. The form and motions of the earth. Its division into land and water. Size and shape of continents. Low lands, their position and the names by which they are known. High lands or plateaux. Hills. Mountains and mountain systems. Valleys.
2. The ocean and its extent. The names given to different parts. Its depth where known. Its saltness. The movements of the ocean. Marine currents. Waves.
3. Rivers and river systems. Lakes.
4. The air, its nature, extent, and principal uses. Permanent winds. Periodical winds. Storms.
5. Dew. Clouds and rain. Snow and hail. Nature of climate.
6. The nature of earthquakes. The nature of a volcano. Earthquake bands and bands of volcanic action. The simple phenomena of a volcanic eruption.
7. The mode in which plants and animals are distributed on the earth. The mutual relations of horizontal and vertical distribution. The meaning of representative species and the principal groups of plants and animals that represent others in different continents and large islands.
8. The different races of men. The mode in which they are now distributed on the earth.

The examination questions set in this elementary paper will not involve more than a knowledge of such facts as are taught in the ordinary text books.

For a *mere pass* it will only be required that the answers should be so far correct and definite as to show that reasonable care has been taken in explaining the subject, assuming ordinary intelligence and exertion on the part of a young pupil. For a *first class* in this stage sound elementary knowledge and clearness of definition will be indispensable.

Second Stage or Advanced Course.

The more advanced students, who come up in the second stage, will not pass without exhibiting something more than mere elementary knowledge. They must have a knowledge of principles as well as facts. They will be expected to have acquired—

a. So much elementary astronomy as relates to the position of the earth in the solar system, its magnitude and rotation, and the influence of the sun, moon, and other bodies distributed through space on terrestrial phenomena.

b. So much of elementary physics and inorganic chemistry as includes the nature and mode of action of the physical forces and the composition of rocks.

c. So much of elementary geology and mineralogy as includes a knowledge of the nature of rocks, their superposition, succession, and disturbances.

d. So much of palæontology as includes a knowledge of the distribution of life in time.

The bearing of these departments of knowledge on physical geography commonly so called should be understood. The terms used in them must be well appreciated and briefly defined when definitions are asked.

The following more complete synopsis of physical geography will show the nature of an advanced course of instruction :—

1. Land. Relation of continents and islands. Protuberance of land and preponderance of land in one hemisphere. Form of extremities of land. Grouping of islands. The geographical axes of the two continents. Influence of the form of a coast line. Characteristic features of the various great masses of land.
2. Mountain axes and mountain systems. Details of the great mountain systems of the world, especially with regard to the continents.

Relations of the different parts of the great mountain system of Europe and Asia. Isolated mountains and mountain system of Africa. Mountain system of America. Culminating points. Knots in mountain chains.

3. High plains or plateaux; their nature and position. Their relations with the geographical axes and to geological structure. Examples of plateaux. Plateaux in small islands. Sierras or mountain ridges rising from plateaux. The drainage of plateaux by deep narrow valleys.
4. Low plains; their distribution and relation to high plains and mountains. The low plains of the principal natural divisions of the world. The steppes of Asia. Deserts of Africa and Arabia. Savannahs and prairies of North America. Silvas, Llanos, Pampas of South America. The characteristics of each. Valleys; their varieties and peculiarities. Difference between mountain valleys and the valleys of plateaux.
5. Water; its position on the earth. Natural divisions caused by the protuberance of parts of the earth. Oceans and inland seas. Depth of the ocean, and means of ascertaining its depth. Nature of the ocean floor. Form of the bottom of the ocean. Solid contents of water. Density of water under different circumstances. Effect of cold on water. Temperature of the sea. Colour of water.
6. Motion of water. Waves. The tidal wave. Currents. The principal stream currents. Drift currents. Irregular movements of water. Sargasso seas.
7. Circulation of water by rivers. Drainage areas and river basins. Nature of water sheds. Origin of rivers. Floods and flood moderators. River systems of the world. Rivers draining into the ocean. Rivers draining into lakes. Groups of lakes; their extent and peculiarities. Waterfalls and rapids.
8. Circulation of water in the interior of the earth. Course of rain water through rock. Issue of this water in springs. Temperature of springs. Mineral and gaseous contents of springs. Quantity of water issuing from springs, and of solid matter deposited by them. Variation of springs.
9. Conveyance of water by clouds, and its deposit as rain. Distribution of rain. Proportion of rainfall that runs over the earth's surface. Formation of snow. Circumstances under which it is formed and deposited. Snow line; its position in different parts of the world. Passage of snow into ice. Glaciers; their ancient and modern history. Glacial action; its nature and results. Icebergs—how and where formed; their influence. Hail; its formation and effects.
10. The atmosphere. Composition and properties of air. Its uses and effects on light. Its extent. Its colour. Effect of heat on the atmosphere. Waves of sound. Nature of wind. Permanent winds. Periodical winds. Circulation of the air by upper currents from the equator to the poles, and corresponding return currents from the poles to the equator. Distribution of winds in both hemispheres. Special local winds and their cause. Various kinds of storm winds. Nature of cyclonic storms. Phenomena connected with such storms.
11. Phenomena of weather and climate. Causes that produce or modify climate. Lines connecting places having equal annual, equal summer, or equal winter heat. Value of such lines as indicating climate. Conditions that affect weather and climate. Cycles of weather and climate. Changes of climate, and the cause of such changes.
12. Volcanic phenomena. General action of volcanoes. The conditions of a volcanic eruption. The parts of the world that contain volcanoes. Number of volcanoes in the different groups; their position and

history of the eruptions. Inactive or extinct volcanoes. Pseudo-volcanoes and phenomena connected with decaying volcanic activity. Geysers, solfataras, and mud volcanoes. Volcanic action under the sea. Periods and cycles of volcanic disturbance. Earthquakes. Zones of earthquake disturbance. Relation of earthquakes to volcanoes. Periodicity of earthquakes.

13. Distribution of life on the earth. Persistence of life. Origin of species. Modification of species. Grouping of plants. Representative and typical species. Advance of certain forms of plant life. Migration and migratory powers of plants. Floras of different countries. Distribution of floras. Faunas, their distribution. Groups of characteristic animals. Migration and migratory instincts. Limitation of these instincts. Distribution of plants and animals in time. Extinction and replacement of species.

14. Distribution of man. Date of introduction of the human family. Early existence of certain typical groups. Mode in which these groups differ anatomically among each other. Mixed races. Migrating and settled races, and their mutual influence. Natural and artificial limits of extension of the various races. Influence of man on external nature.

Sound knowledge of the main facts and an acquaintance with the mode of action of natural causes to produce results will be expected from the more advanced students.

EXAMINATION FOR HONOURS.

For this examination it will be expected that the candidates shall not only be familiar with the ordinary facts and inferences, but that they should be able to give a tolerably complete outline in their own language of groups of facts and their mutual bearing, together with explanations of natural phenomena on which the principles of physical geography depend.

Sound knowledge acquired, not only from text books, but from a thoughtful examination of the views of various authors or from a personal study of the facts and phenomena will be expected from those who seek an honour certificate, and very clear and definite information on the subjects attempted will be indispensable.

For instruction in physical geography there are several recognised text books. It unfortunately happens that in some of the text books in use in science schools, important facts are incorrectly stated, and teachers employing them must be careful to make the requisite alterations in their course of teaching.

TEXT BOOKS.

The following books may be mentioned :—

(1.) For elementary instruction in science classes.

The World we Live in, or First Lessons in Physical Geography, by Prof. D. T. Ansted, 12mo., 2*s*. (London, Allen & Co., new ed., 1869.)

Outlines of Physical Geography, by E. Hughes, 12mo., 3*s*. 6*d*. (London, Longmans, new ed., 1866.)

Text Book of Physical Geography, by Dr. Page, 12mo., 2*s*. (Edinburgh, Blackwood, 1863.)

Physical Geography for Schools, by M. F. Maury, 12mo., 2*s*. 6*d*. (London, Longmans, 1864.)

(2.) For advanced instruction :—

Physical Geography, by Prof. D. T. Ansted, small 8vo., with maps, 8*s*. (London, Allen & Co., new ed., 1870.)

Physical Geography, by Mrs. Somerville, new edition, revised by H. W. Bates, Sec. R. Geogr. Soc. (London, Murray, 1870.)

Physical Geography, by Sir John Herschel.

Two Thousand Examination Questions in Physical Geography, by Prof. D. T. Ansted, 12mo., 2*s*. (London, Allen, 1870.)

(3.) For general reference:—

Physical Geography of the Sea, by M. F. Maury, 8vo., 5*s*. (London, Sampson, Low, & Co., 12th ed., 1866.)

Rain and Rivers, by Col. George Greenwood, 8vo. (London, Longmans, 2nd ed., 1866.)

Man and Nature, by George P. Marsh, 8vo. (London, Sampson, Low, & Co., 1864.)

Prichard's Natural History of Man, 8vo. (London, Baillière, 1848.)

Principles of Geology, by Sir C. Lyell, 2 vols., 8vo., 32*s*. (London, Murray, 10th ed., 1868.)

Physical Geography and Geology of Great Britain, by A. C. Ramsay, 8vo., 5*s*. (London, 2nd ed., 1864.)

Principles of Seismology, by R. Mallet, 2 vols., 8vo., 63*s*. (London, Chapman & Hall, 1862.)

Cosmos, by A. von Humboldt, translated by Mrs. (now Lady) Sabine, 3 vols., 12mo. (London, Longmans.)

Aspects of Nature, by A. von Humboldt, translated by Mrs. (now Lady) Sabine, 2 vols., 12mo. (London, Longmans.)

Asie Centrale. Recherches sur les chaînes des montagnes et la Climatologie comparée, 3 vols., 8vo. (Paris, 1843.)

Distribution of Heat over the Surface of the Globe, illustrated by Curves of Temperature, by H. W. Dove, 4to. (London, 1853.)

The Law of Storms, considered in connexion with the ordinary movements of the Atmosphere, by H. W. Dove, translated by R. H. Scott, 8vo. (London, 1863.)

Géographie Botanique raisonnée, ou exposition des faits principaux et des lois concernant la distribution géographique des plantes de l'époque actuelle, par J. de Candolle, 2 vols., 8vo. (Paris, 1855.)

An Account of the great Floods of August 1829 *in the Province of Moray and adjoining Districts*, by Sir Thomas Dick Lauder, Bart., 8vo. (Edinburgh, Black.)

An Attempt to develope the Law of Storms, by Lieut.-Colonel W. Reid, C.B., R.E. (London, Weale, 1838.)

In addition to the above, many other works in special departments of the science will be found useful to the advanced student and to the candidate in honours. The following are examples:—

Physical Geography of the Sea, by M. F. Maury, 8vo., 5*s*. (London, Low, 12th ed., 1866.)

Man and Nature, by G. P. Marsh, 8vo., 14*s*. (London, Low, 1861.)

Principles of Geology, by Sir C. Lyell, 2 vols. 8vo. (London, Murray, 1866.)

Principles of Seismology, by R. Mallet, 2 vols. 8vo., 63*s*. (London, Chapman and Hall, 1862.)

Physical Geography in its relation to the prevailing Winds and Currents, by J. K. Laughton, 10*s*. 6*d*.

It is most desirable that Physical Geography should be taught and studied with good physical maps at hand. For the elementary course is recommended—

Small Atlas, by Hughes.

For the advanced student:—

Physical School Atlas, by Johnston.

Larger Physical Atlas, by Johnston.

APPENDIX C.

TABLES showing the NUMBER of STUDENTS in each SCIENCE SCHOOL or CLASS, and the SUBJECTS taught.

TABLE I.

LIST of SCIENCE SCHOOLS in existence on the 1st March 1870, giving the NUMBER of STUDENTS returned as under INSTRUCTION in MAY 1868 and MAY 1869, and the NUMBER of PRIZES and MEDALS obtained in MAY 1868 and MAY 1869.

Schools established since May 1869 are printed in italics.

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
				ENGLAND.									
Abingdon	Brit. Sch.	Harper, Rev. E. T. H.	Davis, J. G.	Gubb, E. J. Gubb, A. Butler, E. Payne, F. W.	46	63	16	..	14	1	..	..	2s. 6d. ea. subject.
Accrington	Mech. Inst.	Hargreaves, B.	Ratcliffe, W.	Brown, T. Edwards, S.	29	39	10	..	18	5	..	..	2s. 6d.
Accrington	*Christ Ch. Nat. Sch.*	*Hargreaves, B.*	*Ratcliffe, W.*	*Bogle, J.*	..	..	..	..	..	..	..	..	2s.
"	*25, Bridge St.*	"	"	*Eltoft, T.*	..	..	..	..	..	..	..	..	3s.
Alderley Edge (Manchester)	Reading Room	Consterdine, Rev. J. W.	Railton, G. W.	Dale, J. Dawson, C. J.	18	16	..	2	6	1	..	..	2s. per qr.
Almondbury (Huddersfield)	Gram. Sch.	Hulbert, Rev. C. A.	Dyson, E.	Easther, Rev. A. Jarmain, G	26	25	..	1	2	..	..	..	12l. 10s. per annum.
Alnwick	Mech. Inst.	Trotter, Rev. E. B.	Robertson, A.	Muxlow, T.	28	38	10	..	..	1	..	..	2s. 6d.
Andover	Gram. Sch.	Clarke, T. P.	Footner, R.	Marriott, J. T.	39	31	..	8	6	..	..	..	2s. 6d.
Armley (Leeds)	*Nat. Sch.*	*Smith, Rev. F. G.*	*Goodall, Rev. W.*	*Breare, W.*	..	..	..	..	..	..	..	..	Nil.
Ashby-de-la-Zouch	Mut. Imp. Soc.	Green, Rev. T. S.	Dalby, J.	Gibson, G. H.	19	27	8	..	8	..	..	..	2s. 6d. to 5s.
Ashton-under-Lyne	Mech. Inst.	Mason, H.	Andrew, J.	Jones, T.	29	25	..	4	12	1	..	..	1s. per qr. each subj.
" "	Hurst Mech. Inst.	Whittaker, R.	Pleasants, J.	Stott, H., sen.	..	12	12	..	..	4	..	..	2s.
Ashton-under-Lyne	*St Michael's Y. Men's Class*	*Moss, J.*	*Buckley, E.*	*Booth, I.* *Cooke, J. B.*	..	..	..	..	..	..	..	..	1s. each subject.
" "	*Dukinfield Village Library and Old Chapel Schs.*	*Marshall, W.*	*Broadrick, E. B.*	*Robinson, E.* *Jones, T.*	..	..	..	..	..	..	..	..	2s. to 3s.
Backworth (Northumberland)	*Old Chapel*	*Richardson, H.*	*Hunter, J.*	*Rowden, W. T.* *Kernick, R.* *McDougall, T.*	..	..	..	..	..	..	..	..	5s.
Bacup	Mech. Inst.	Aitken, J.	Hargreaves, J. H.	Shore, T. W. Sutcliffe, G. W.	42	35	..	7	27	..	..	1 B.	2s. to 2s. 6d.

„ (Lanc.)	Wes. Day Sch.	Carr, Rev. J.	Lord, W. H.	Holland, J	..	10	10	..	..	7	..	..	1s. 6d. per quarter.
Balham	Wkg. Men's Inst.	Large, Rev. W. A. A.	Loat, J. H.	Jones, T.; Brittle, J. R.	..	18	18	..	..	..	..	..	6s.
Banbury	Brit. Sch.	Grimbly, J.	Hewett, G. A.	Beale, J. H.; Owen, A.	48	47	..	1	8	..	1 B.	..	2s. 6d. to 5s.
„	Mech. Inst.	Cobb, T. R.	Wilson, A.	French, A.	..	13	13	..	..	1	..	..	2s. 6d. & 5s.
Bangor	*Normal College*	*Hughes, W. B., M.P.*	*Jones, G.*	*Thomas, J.*	..	..	..	..	..	..	..	..	Nil.
Banstead (Surrey)	Nat. Sch.	Glyn, Hon. P. C.	Buckle, Rev. E. V.	Knibbs, H.	..	38	38	..	..	1	..	..	2s. per subject.
Barnard Castle	Mech. Inst.	Brown, Rev. F.	Monkhouse, J.	Witter, J. A.; Bailey, G. H.	..	10	10	..	..	..	..	..	2s. per mo. each subj.
Barnsley	„	Allen, T.	Gration, J.	Brears, W.	18	17	..	1	1	1	..	..	2s. 6d.
Barnstaple	Lit. and Sci. Inst.	Guppy, T. W. M. A.	Mackrell, T.	Dunston, J. J.; Maunder, S. G.	..	73	73	..	..	..	..	..	5s. 6d. ea. subject.
Bath	*St. Mark's Nat. Sch.*	*Sproule, Rev. J. W.*	*Shaw, Rev. W. S.*	*Nevill, M.*	..	..	..	..	..	..	..	..	2d. per wk.
„	*Weston Boys' Sch.*	*Bond, Rev. J.*	*Stedman, Rev. J.*	*Knight, J.*	..	..	..	..	..	..	..	..	2s.
Batley	Mech. Inst.	Jubb, J.	Hick, W. H.	Osborne, J.; Brears, W.	..	8	8	..	..	1	..	..	5s.
Batley	*Indepent. Sch.*	*Rae, Rev. J.*	*Ellerby, R.*	*Brears, W.*	..	..	..	..	..	..	..	..	Nil.
Beccles (Suffolk).	Science Sch.	Crowfoot, W. M. B.	Mayhew, J.	Boyce, H.	..	27	27	..	..	..	..	..	5s.
Bedford	Commercial Sch.	Gray, T. T.	Fry, P. S.	Glover, A. W.	..	21	21	..	..	3	..	..	2s. 6d. to 15s. each subject.
Bedlington	*Colliery Sch.*	*Whitley, Rev. C. T.*	*Fisher, W.*	*Rowden, W. T.; Kernick, R.; Wallace, J.*	..	..	..	..	..	..	..	..	5s.
Berkeley (*Glos.*)	*Ch. of Eng. Sch.*	*Turton, Rev. H. M.*	*Phillips, J. G.*	*Hodgson, J. J.*	..	..	..	..	..	..	..	..	2s. 6d.
Bingley (Leeds)	Mech. Inst.	Irwine, Rev. A. P.	Holgate, R.	Severs, G.	17	19	2	..	3	1	..	..	Nil.
Birkenhead; „	Laird St.; Hamilton St.	Taylor, J.	Hinde, W. E.	Bentley, J.; Nicol, J. C.	..	30	30	..	..	3	..	..	6s. to 10s. 6d.
Birmingham	B. and Mid. Inst.	Kenrick, W.	Smith, E.	Woodward, C. J.; Hinds, W.; Hinds, J.; Bulpitt, W. T.; Causer, W. G.	152	230	78	..	49	22	1 B.	..	1d. a night to 14s. per term.
„	Sch. of Art	Cope, C. R.	Laundy, E.	Raimbach, D. W.; Causer, W. G.	75	77	2	..	33	13	1 B.	..	65l. 3s. 6d. total amt.
„	Bloomsbury Inst.	Milward, Rev. H. C.	Aston, J.	Smith, D.; Smith, A. F.; Walton, W.	80	104	24	..	26	8	..	..	2s. to 9s.
„	Clarendon Chambs.	Manton, H.	Southall, A.	Smith, D.; Turner, J.; Davis, J.	11	30	19	..	8	4	..	..	2s. to 3s.
„	Deritend W. M. Assoc.	Solomon, H.	Greening, W. H.	Bagley, T.; Roberts, A.; Bridge, T. W.	..	23	23	..	..	..	..	..	Nil.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
Birmingham	Graham St. Inst.	Vince, Rev. C.	Player, J.	Lancaster, W. J.; Jennings, J. M.	..	24	24	..	..	2	..	..	1s. 6d.
"	Bishop Ryder's Sch.	Yorke, Hon. and Rev. G. M.	Burges, Rev. J. H.	Paterson, C.; Thornelee, T.; Shirley, J.	..	40	40	..	..	..	..	..	4d. per wk.
"	Middle Class Sch.	Rolason, W.	Payton, H.	Causer, W. G.; Smith, G.	..	19	19	..	..	2	..	..	Nil.
"	Ch. of the Sav. Sch.	Myers, Rev. E.	Hemming, W. H.	Embrey, G.	..	20	20	..	..	..	..	..	1s. per qr. each subj.
"	St. George's	Thornton, Rev. S.	Smith, G.	Bulpitt, W. T.	..	58	58	..	..	6	..	1 S.	1s.
"	New Jerusm. Sch.	Tonks, S.	Osborne, J.	Jones, G. F.	..	7	7	..	..	..	..	..	Nil.
"	St. Mark's Sch.	Thwaites, Rev. H. G.	White, W.	Buckley, H. C.; Robins, H. St. J.	..	59	59	..	..	..	..	..	1s. 6d. ea. subject.
"	St. Mary's, Bath St.	Barrett, Rev. J. C.	Edwards, J. R.	Bulpitt, W. T.; Betton, A.	..	16	16	..	..	..	..	..	1s.
"	St. Clement's Sch.	Milward, Rev. H. C.	Eden, W.	Bulpitt, W. T.; Hayfield, W.	..	20	20	..	..	5	..	..	1s.
"	St. Paul's Sch.	Burgess, Rev. R. B.	Langford, J. A.	Embrey, G.; Bulpitt, W. T.; Betton, A.; Roberts, T.	..	66	66	..	..	..	..	..	Nil.
Birmingham	*Steel House Lane Sch.*	*Manton, H.*	*Manton, H., jun.*	*Walton, W.*	..	..	..	..	..	..	..	..	6d. per qr.
"	*St. Matthias Sch.*	*Bray, Rev. H. T.*	*Jacombs, W. H.*	*Bulpitt, W. T.*	..	..	..	..	..	..	..	..	1s.
"	*Blue Coat Sch.*	*Pettitt, Rev. G.*	*Price, H.*	*Dunn, G. S.*	..	..	..	..	..	..	..	..	Nil.
"	*Mut. Imp. Soc.*	*Hinks, J.*	*Langford, J. A.*	*Embrey, G.*; *Roberts, T.*	..	..	..	..	..	..	..	..	Nil.
"	*Wes. Sch., Hatchett St.*	*Hearnshaw, Rev. J.*	*Bloxham, J.*	*Pilter, W. T.*	..	..	..	..	..	..	..	..	1s. 6d. per session.
"	*Friends' Bible Assoc. Rooms*	*Sturge, C.*	*Southall, A.*	*Turnor, J.*	..	..	..	..	..	..	..	..	1s.
"	*Trade Sch., Rocky Lane*	*Manton, H.*	*Austin, W.*	*Walton, W.*	..	..	..	..	..	..	..	..	1s. 6d. per term.
Birstall (Leeds)	Mech. Inst.	Heald, Rev. W. M.	Priestley, J. W.	Patchett, I.	26	53	27	..	22	2	..	..	1s. 6d. ea. subject.
Bishop Auckland.	*Wes. Sch.*	*Chambers, Rev. W.*	*Hepton, Rev. T.*	*Marshall, H.*	..	..	..	..	..	..	..	..	2s. 6d. to 5s.
Bishop Stortford.	*Lit. Inst.*	*Starling, G. A.*	*Blunt, Rev. A. H.*	*Morgan, J. H.*	..	..	..	..	..	..	..	..	6s. to 7s.

Blackburn	Wes. Sch.	Woodhouse, Rev. C. W.	Parkinson, G.	Isherwood, T.	9	35	26	..	..	8	..	..	2s. 6d.
"	Ch. Inst.	" "	Elwell, Rev. H.	Sayle, J.	..	6	6	..	..	..	..	..	2s. 6d. ea. subject.
Blackburn	*Town Hall*	*Woodhouse, Rev. C. W.*	*Parkinson, G.*	*Hurst, W.*	..	..	..	..	..	..	..	..	2s. ea. sub.
Blackley (Manchester).	Assembly-room	Langton, W.	Schofield, J.	Hurst, W.	..	31	31	..	..	2	..	..	Tot. amt. 72s.
Blyth (Northumberland).	Nat. Sch.	Greenwell, Rev. W.	Rees, W.	Bowden, W. T. Kernick, R. Wallace, J.	..	46	46	..	..	6	..	..	5s.
Bodmin	Lit. Inst.	Stokes, H. S.	Phillipps, J.	Downing, S.	31	69	38	..	16	1	..	..	1s. to 3s. 6d.
Bolton	Sci. and Art Sch.	Powell, Rev. H.	Doman, Rev. J. G.	Collins, J. Spriggs, C.	193	161	..	32	37	5	..	..	1s. to 2s. each sub.
"	Mech. Inst.	Barlow, J.	Dakeyne, J.	Spriggs, C. Goulding, E.	67	64	..	3	16	4	1 B	..	1s. 6d. per quarter.
"	Dean Mills B. Sch.	Callender, W. R.	Maycock, W.	Spriggs, C.	..	20	20	..	..	1	..	..	3s.
Bolton	*Unitarian Day Sch.*	*Harwood, J.*	*Rigby, T.*	*Andrews, H.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Boston	Sci. and Art Sch.	Blenkin, Rev. G. B.	Lowe, Rev. G. W.	Howard, V. Gandy, J.	.. ..	18 25	18 25	.. ..	.. ..	4	..	..	1s. and 2s. per mo. each sub.
"	Nat. Sch.	" "	" "	Gane, W.	..	..	..	..	..	..	..	..	1s. to 2s.
Bow	Schoolroom, Old Ford Road	Schnadhorst, E.	Smith, E.	Saunders, J. Duff, C.	..	20	20	..	..	6	..	..	6s.
Bradford	Mech. Inst.	Law, J.	Holbrey, J.	Severs, G.	..	10	10	..	..	3	..	..	1s. to mem.
Bradford	*Schoolmasters' Cl.*	*West, E.*	*Miall, L. C.*	*Jarmain, G.*	..	..	..	..	..	..	..	..	10s. 6d.
"	*Wes. Sch.*	*Walker, Rev. S.*	*Ives, J.*	*Sugden, W.*	..	..	..	..	..	..	..	..	4s. 6d.
"	*Hallfield Sch.*	*Hick, J.*	*Claxton, E. A.*	*Watson, M.* *Monckman, J.*	..	..	..	..	..	..	..	..	2s. per qr.
Bramley (Leeds)	*Grove House*	*Golt, Rev. J.*	*Seppings, Rev. D. W.*	*Ramsay, E. J.* *Cope, Rev. S. W.*	..	..	..	..	..	..	..	..	5s.
Breage (Cornwall).	Institution	Pridmore, Rev. E. M.	Argall, W.	Kitto, B. Eudey, J.	23	52	29	..	17	2	2 B.	..	2s. 6d. to 5s.
" "	Germoe, N. S.	" "	"										
Bredbury (Stockport)	*St. Mark's N. S.*	*Vandry, W. C.*	*Hartley, T.*	*Lea, J.*	..	..	..	..	..	..	..	..	2s. 6d.
Bridport	*Lit. and Sci. Inst.*	*Montagu, J. P.*	*Chowne, Rev. J. H.*	*Campbell, J. A. D.*	..	..	..	..	..	..	..	..	10s. to 20s. per ann.
Brigstock (Northants).	Farming Woods Sch.	Attenborough, J.	Bradshaw, W. P.	Garner, S.	..	53	53	..	..	2	..	..	2s. 6d. ea. subject.
Brington (Northamp.)	*Nat. Sch.*	*Wykes, J.*	*Ponsonby, Rev. F. J.*	*Seal, C.*	..	..	..	..	..	..	..	..	1d. per wk
Bristol	Trade Sch.	Moseley, Rev. Canon	Wilkson, J.	Coomber, T. Plant, E. C. Welsh, J. Richards, W. Morgans, W. Leipner, A.	145	200	55	..	166	94	1 G., 1 B.	1 G. 1 S. 3 B.	3s. to 15s. per qr.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
Bristol	Young Men's Christ. Assoc.	Cornall, Rev. R.	Williams, W. H.	Ewens, F. T.	..	17	17	..	..	4	..	..	2s. 6d. and 10s. 6d.
Bristol	*North St. Wes. Sch.*	*Clapham, Rev. J.*	*Budgett, W. H.*	*Mawbey, H.*	..	..	..	..	..	..	..	..	2s. 6d.
Brixham (Devon).	*Brit. Sch.*	*Lakeman, T.*	*Putt, R.*	*Trotter, G. O.*	..	..	..	..	..	..	..	..	2s.
Bromsgrove	Lit. and Mech. Inst.	Murray, Rev. G. W.	Gibson, G. W.	Dodd, W.	26	66	40	..	7	..	..	..	2s. 6d.
Burnley	Lit. Inst.	Parker, Rev. A. T.	Briggs, B. W.	Shore, T. W.; Pickup, W.; Bell, T.	58	47	..	11	14	5	..	..	2s. 6d. to 4s. 6d.
"	Mech. Inst.	Shuttleworth, Sir J. P. K.	Sutherland, J.	Shore, T. W.; Thompson, J.	48	77	29	..					2s. 6d. to 3s. 6d.
"	Gram. Sch.	"	"	Wilkinson, T. T.; Shore, T. W.	40	40	..	..	12	4	..	..	Grm. Sch. 1s. per 12 lessons.
Burnley	*St. Peter's Sch.*	*Shuttleworth, Sir J. P. K.*	*Sutherland, J.*	*Shore, T. W.*	..	..	..	..					
Burnley	Carlton Road Sch.	Harrison, R.	Graham, J.	Grant, J.	61	59	..	2	6	..	..	..	1s. per qr. each sub.
Burslem	*Sch. of Sci. and Art*	*Davenport, H. T.*	*Woodall, W.*	*Theaker, G.*	..	..	..	..	..	..	..	..	2s. per mo. each sub.
Bury (Lanc.).	Athenæum	Wormald, J.	Probert, T. W.	Spriggs, C.	79	77	..	2	25	10	..	..	2s. per qr.
Caistor	Lower Gram. Sch.	Maclean, Rev. H.	Mowbray, Rev. J. H. M. de	Thomas, R.	..	13	13	..	..	..	..	..	2s. 6d. ea. subject.
Calverley (Leeds).	*Mech. Inst.*	*Yewdall, D.*	*Kellett, J. jun.*	*Harrison, J.*	..	..	..	..	..	..	..	..	Nil.
Camborne	Lit. Inst.	Smith, W. B.	Butlin, C. H.	Provis, T. B.; Collins, J. H.	24	12	..	12	5	..	..	..	2s. 6d. to 10s.
Canning Town (Essex)	Holy Trinity Sch.	Delap, Rev. A. B.	Peacock, W. H.	Shipman, C.; Downar, W. A.	12	34	22	..	5	6	..	..	5s.
Cardiff	Free Library	Taylor, W.	Price, P.	Bush, J.; Bush, W.	63	91	28	..	27	10	..	..	5s. per qr.
Carharrack (Cornwall).	Lit. Inst.	Tucker, J. B.	Green, R.	Collins, J. H.	..	20	20	..	..	..	..	..	Nil.
Carmarthen	*Trg. Coll.*	*Jones, Rev. L. M.*	*Jenkins, Rev. R. B.*	*Morris, Rev. R. H.; Marshall, Rev. F.*	..	..	..	..	..	..	..	..	Not yet fixed.
Charlesworth (Derbyshire).	*Mech. Inst.*	*Shipley, D.*	*Cooper, M.*	*Booth, S.*	..	..	..	..	..	..	..	..	2s.
Charlton, New (Kent).	*Math. Inst. Whs., Woolwich Road.*	*Balgarnie, Rev. R.*	*Scott, W.*	*Hepburn, R.*	..	..	..	..	..	..	..	..	6s.

Chatham	St. Mary's Nat. Sch.	Stephens, Rev. H. B.	Wilkins, T.	Byatt, H.; Sanguinetti, P. A.; Laskey, J. J.	40	57	17	..	26	6	..	..	7s. 6d.
"	St. Mark's	Neville, H. J. W.	Bridger, J.	Byatt, H.; Brazier, C.	27	37	10	..	19	10	..	1 G.	7s. 6d.
Cheltenham; "; "	Sch. of Sci.; Trg. Coll.; Brit. Sch.	Skillicorn, W. N.	Philipps, J. S.	Ewens, F.; Brereton, E. W.; James, H. A.; Bromilow, W.	212	64	..	148	32	5	1 G.	..	2s.
"	Whitworth Sch.	Ford St. C.	Dixon, R. J.	Davis, W. S.; Jeffery, W.; Davis, T. H.	..	266	266	..	..	14	..	1 B.	2s. 6d. to 10s. 6d. per quarter.
Chester	Sch. of Art	Howson, Very Rev. J. S.	Deacle, Rev. E. L. Y.	Craister, W.	30	45	15	..	8	5	..	..	2s. per mo. 2s. 6d. the course.
Chesterfield	*Nat. Sch.*	*Carrington, T.*	*Booth, G.*	*Francis, E.*	..	..	..	..	..	..	..	..	5s. ea. sub.
Chorley	St. George's Nat. Sch.	Barton, R. H.	Stock, Rev. J.	Brown, T.	20	15	..	5	7	3	..	..	3s.
Church (Accrington)	Nat. Sch.	Birchall, Rev. J.	McKenzie, T. S.	Sutcliffe, G.; Boyd, P.	..	57	57	..	..	2	..	..	2s. to 3s. per sess.
Cirencester	*Sch. of Art*	*Millar, Rev. J. O.*	*Zachary, H.*	*Miller, J.*	..	..	..	..	..	..	..	..	10s.
Clay Cross	*Public Hall*	*Binns, C.*	*Halliday, T.*	*Francis, E.*	..	..	..	..	..	..	..	..	5s.
Coalbrookdale	Lit. and Sci. Inst.	Dickinson, H.	Squire, E. L.	Woolner, H.	..	25	25	..	..	..	..	..	4s.
Colne	Gram. Sch.	England, T. T.	Phillips, T.	Bell, T.	..	30	30	..	..	4	..	..	5s.
Compstall (Stockport)	Athenæum	Andrew, G.	Fernley, J.	Parnell, G.; Bradshaw, G.	27	26	..	1	20	8	..	..	2l. 14s.
Cottesmore	*Nat. Sch.*	*Stuart, Rev. A. G.*	*Miles, Rev. S.*	*Cattell, T.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Coventry	St. Peter's N. S.	Odell, J.	Tabberer, Rev. G.	Bates, J.	..	30	30	..	..	..	..	..	1s. per qr.
Crawshawbooth	*Mech. Inst.*	*Brooks, T.*	*Taylor, J.*	*Sutcliffe, G. W.*	..	..	..	..	..	..	..	..	2s. 6d. to 5s.
Crewe	Mech. Inst.	Ramsbottom, J.	Jackson, J. A.	Craister, W.	44	31	..	13	20	9	..	..	2s. per mo. or 2s. 6d. the sess.
Croydon	Lit. and Sci. Inst.	Carpenter, A.	Lanchester, H. T.	Childs, T.; Jones, T.	32	17	..	15	13	..	..	..	5s.
Croydon	*St. Andrew's N. S.*	*Long, Rev. D.*	*Smith P.*	*Busbridge J.*	..	..	..	..	..	..	..	..	5s.
Culham (Oxfordshire)	Trg. Coll.	Pott, Rev. A.	Causton, Rev. F. J.	Ridgway, Rev. J.; Herbert, Rev. A.; House, J.	27	23	..	4	3	5	..	..	Nil.
Dartmouth	Nat. Sch.	Newman, A.	Rees, W. H.	Hamlyn, E.	26	39	13	..	6	..	..	..	4s. ea. subj.
Darwen	Mech. Inst.	Blamire, Rev. W. H.	Neville, E.	Hurst, W.	14	9	..	5	8	..	..	..	2s. 6d. ea. subject.
Daventry (Northants).	Gram. Sch.	Collyns, Rev. P. M.	Marriott, T. H.	Rigby, J.	..	16	16	..	..	1	..	..	6d. per mo.
Deptford	St. Paul's Sch.	Lewes, S. S.	Marchant, T. W.	Busbridge, W.; Hopper, T.; Ellercamp, H.; Cleminson, J.	21	85	64	..	27	17	..	..	5s.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
Deptford	*Mission Hall* / *St. John's Sch.*	*Money, Rev. C. F. S.*	*Earland, T.*	*Mondy, E. F.* / *Farncomb, E.*	..	..	..	..	..	..	..	..	9*s.*
Derby	Gram. Sch	Evans, T. W.	Goode, H.	Greaves, C. A.	12	10	..	2	..	..	..	..	Nil.
Devonport	Mech. Inst.	Rolston, J.	Chapple, S.	Balkwill, F. P.	..	8	8	..	..	..	..	..	5*s.*
Devonport	14, *St. Aubyn Street*	*Greaves, Rev. H. A.*	*Cuddeford, T.*	*Evers, H.*	..	..	..	..	..	..	..	..	5*s.*
Dewsbury	Mech. Inst.	Day, E.	Warburton, J.	Shaw, J. / Nettleton, W. / Tinker, H.	17	17	..	..	1	1	..	..	2*s.* 6*d.* to 5*s.*
Dewsbury	*Wes. Lit. Soc.*	*Rawsthorne, J. J.*	*Thompson, W. R.*	*Osborne, J.*	..	..	..	..	..	..	..	..	5*s.*
Doncaster	Guildhall	Pigon, Rev. F. / Hatfield, C. W.	Taylor, A.	Constable, J.	..	24	24	..	..	2	..	..	2*s.* 6*d.* per quarter.
Doncaster	*G. N. R. Sch.*	*Campion, Rev. J.*	*Kyle, Rev. J.*	*Branston, Z. H.*	..	..	..	..	..	..	..	..	2*s.* 6*d.*
Droitwich	*Nat. Sch., Holloway*	*Topham, Rev. J.*	*Lea, Rev. W.*	*Jeacock, J. S.*	..	..	..	..	..	..	..	..	2*s.* 6*d.* ea. subject.
Droylsden	Educ. Inst.	Hadwen, J.	Hadfield, J.	Hurst, W. / Kay, W. / Riley J. / Baguley, M.	58	49	..	9	23	13	..	..	2*s.* each subject.
Dudley	Mech. Inst.	Gibson, Rev. M.	Hollier, E.	Causer, W. G. / Marshall, W. W.	..	69	69	..	..	1	..	..	9*s.* to 10*s.* ea. subj.
"	Blue-coat Sch.	Wainwright, H. M.	Brettell, T.	Williams, J.	..	50	50	..	..	..	..	..	2*d.* per week, 10*s.* to course.
Dudley	*Netherton Sch.*	*Slade, Rev. J. J.*	*Taylor, Rev. G. J.*	*Green, F.*	..	..	..	..	..	..	..	..	2*s.* ea. subj.
Dunstable	*Ashton Schs.*	*Burgee, S.*	*Howell, F.*	*Hatt, F.*	..	..	..	..	..	..	..	..	1*s.*
Durham	Trg. College	- - - - -	Earle, W. E.	Powley, W. / Howard, C. C.	..	..	..	..	..	..	..	..	Nil.
Eagley	Institute	Greg, A.	Marson, G.	Pinnington, W.	31	20	..	11	5	..	..	..	2*s.* ea. class
Earlestown	Infant Sch.	Whitley, Rev. J.	Shaw, C.	Stott, H. / Burchall, C.	17	24	7	..	5	10	..	..	2*s.* 6*d.*
Earlestown (Newton-le-Willows)	*L. and N.-W. Ry. Works Library*	*Emmett, J. W.*	*Banton, W.*	*Jones, T.*	..	..	..	..	..	..	..	..	1*s.* ea. subj.
Eastington (Glos.)	Nat. Sch.	Peters, Rev. T.	Hooper, C. H.	Wilcox, E.	15	16	1	..	3	2	..	..	1*s.* ea. subj.
Eastwood (Notts.)	Mech. Inst.	Plumptre, Rev. H. W.	Brentnall, A. W.	Fisher, H.	13	9	..	4	6	..	..	..	3*s.* per qr.

Eccleshill (Leeds).	Mech. Inst.	Mercer, Rev. E.	Harland, E.	Harrison, J.	..	..	..	..	..	..	..	..	10s.
Elland (Halifax)	Nat. Sch.	Sandford, Rev. E.	Kaye, U.	Akroyd, B.; Tattersall, A.; Kershaw, T.	22	45	21	..	11	3	..	1 S.	5s.
Elsecar (Barnsley).	Nat. Sch.	Hodges, Rev. W.	Nayler, J.	Washington, M.	..	..	..	..	..	..	..	..	2s. 6d.
Brith	Nat. Sch.	Smith, Rev. C. J.	Desbois, D.	Stanton, G.; Byatt, H.	..	..	..	..	..	..	..	..	5s. per ann.
Evesham	Deacles Sch.	Bentley, Rev. W. de	Burlingham, B.	Sturgess, W.	..	..	..	..	..	..	..	..	Nil.
Exeter	Albert Mem. Mus.	Head, R. T.	Tucker, J. T.	Perkins, F. P.; Sheppard, W.; Jerman, J.	33	34	2	..	11	4	..	..	5s. to 10s.
Failsworth (Manchester)	Mech. Inst.	Wright, R.	Brierley, J.	Stott, H.; Stott, H. junr.	8	20	12	..	1	10	..	..	2s. 6d.
Farnworth	Gram. Sch.	Taylor, Rev. W. H.	Smart, Rev. J.	Spriggs, C.; Cartwright, G. P.	..	32	32	..	..	2	..	..	Nil.
"	Halshaw Moor	Barnes, A.	Prestwich, R. H.	Monks, P.	..	20	20	..	..	2	..	..	Nil.
Farnworth (Bolton).	Wes. Sch.	Hindley, J.	Tetley, Rev. J. D.	Faulkner, J.	..	..	..	..	..	..	..	..	1s. per qr.
" "	St. James' Sch., New Bury	Stewart, Rev. C. J.	Tong, J.	Cooke, S.	..	..	..	..	..	..	..	..	1s. per qr.
Faversham	Institute	Donne, Rev. C. E.	Johnston, S. G.	Field, W.; Batterbee, N.	..	..	..	..	..	..	..	..	Nil.
Finedon (Northants).	Temperance Hall	Dolbein, W. M.	Harlock, J.	Brooks, W. W.	..	..	..	..	..	..	..	..	1s. 6d.
Frampton-on-Severn.	Nat. Sch.	Clifford, H. J.	St. John, Rev. F.	Smith, P. L.	..	..	..	..	..	..	..	..	1s. 6d.
Friezland (Manchester).	Christ Ch. Inst.	Buckley, J. F.	Schofield, G. H.	Kershaw, J.	..	11	11	..	..	..	..	..	5s.
Frome	Sch. of Art	Horner, Rev. Preby.	Singer, J. W.	Goepel, J. S.	..	40	40	..	..	..	..	..	2s.
Frome	Blue-coat Sch.	Daniel, Rev. A.	Daniel, G. A.	Brown, W.	..	..	..	..	..	..	..	..	Nil.
Garforth (Leeds)	Wkg. Men's Club	Whitaker, Rev. G. H.	Woodhead, A.	Schofield, J.	..	..	..	..	..	..	..	..	5s. and 2s.6d. boys
Gateshead	Nat. Sch.	Prest, Ven. Archdea.	Russell, Rev. C. D.	Wheatley, M. J.; Brodie, A.	39	101	62	..	13	7	..	..	5s. ea. subj.
Gateshead	Felling Chem. Works	Redmayne, J. M.	Redmayne, R. R.	M'Laren, J.; Lambton, J. W.	..	..	..	..	..	..	..	..	5s. to 10s. 6d.
Gee Cross (Hyde).	Hyde Chapel Sch.	Thornely, T.	Dowson, Rev. H. E.	Taylor, T.	..	..	..	..	..	..	..	..	1s.
Gildersome (Leeds).	Lit. Inst.	Haslam, Rev. J.	Richardson, G.	Patchett, I.	..	..	..	..	..	..	..	..	3s.
Glossop	Littlemoor M. I.	Atkin, Rev. T.	Wood, S.	Jones, T.	..	..	..	..	..	..	..	..	2s.
Gloucester	Sci. Sch., 10 Eastgate St.	Washbourn, B.	Fowler, Rev. H.	Jeffery, W.; Davis, W. S.	34	19	..	15	..	..	..	..	2s. 6d. ea. subject.
Gloucester	Sch. of Art	Parry, T. G.	Niblett, J. D. T.	Kemp, J.	..	..	..	..	..	..	..	..	6s. per qr.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
Gomersal (Leeds)	Mech. Inst.	Crowther, W.	Kellett, J.	Patchett, I.	..	19	19	..	..	..	..	..	3s. 6d. ea. subject.
Gorton	M. S. and L. R. Y. Society	Peacock, R.	Greenwood, J.	Botheras, R.	..	..	..	..	..	..	..	..	1d. per night.
Grantham	Nat. Sch.	Ostler, W.	Maddison, Rev. G.	Hudson, Rev. R.; Cockman, A.; Fishenden, R. B.	..	12	12	..	..	2	..	1 G.	1s. to 2s. per mo.
Gt. Harwood (Blackburn)	Nat. Sch.	Haslewood, Rev. W. M.	Exley, W.	Loynd, E. B.	..	..	..	..	..	..	..	..	2s. 6d. per session.
Gt. Horton (Bradford)	Wes. Sch.	Barley, Rev. D.	Ritchie, Rev. J.	Martin, W. J.	..	..	..	..	..	..	..	..	Nil.
Greenwich	St. Mary's Girls' N.S.	Miller, Rev. J. C.	Howarth, W.	Wright, H. E.	20	27	7	..	11	2	..	..	5s.
Greenwich	Mech. Inst., Roy. Hill	Purvis, P.	Loughborough, J. G.	Jones, T.; Purnell, W. J.; Browne, L.	..	..	..	..	..	..	..	..	2s. 6d. to 5s.
Guildford	County Hall	Upperton, R. T.	Campbell, C. D.	Goffin, R. E. H.	..	..	..	..	..	..	..	..	4s. per subj.
Halifax	Wkg. Men's Coll.	Akroyd, E., M.P.	Gibb, G.	Jarmain, G.; Stopford, W. H.	35	52	17	..	7	1	1 G. 1 B.	1 B.	5s. per subject.
Halifax	Mech. Inst.	Stansfeld, J.	Watson, J.	Jarmain, G.	..	..	..	..	..	..	..	..	10s. 6d.
„	Sch. of Art	„	Fox, C. J.	Stopford, W. H.; Holland, T.	..	..	..	..	..	..	..	..	5s. ea. subj.
Hammersmith	Training Coll.	O'Keeffe, Rev. D.	Kerckhoffs, J.	Graham, Rev. T.; Livesey, T.; Flannery, T.; Ewright, J.	..	..	..	..	..	..	..	..	Nil.
„	St. Peter's Sch.	Tidcombe, Rev. G. H.	Blackmore, C.	Kehde, H.	..	..	..	..	..	..	..	..	2s. 6d. to 5s.
Hampton	Commercial Sch.	Burrow, Rev. J.	Raw, D. B.	Bickerton, A. W.	..	30	30	..	..	2	..	..	2s. 6d. ea. subject.
Handsworth	St. Michael's Sch.	Anson, Rev. A.	Mordaunt, Rev. O.	Bulpitt, W. T.	..	..	..	..	..	..	..	..	1s.
Harborne (Birmingham)	Y. M. Chr. Assoc., High Street	Roberts, Rev. E.	Collier, J.	Price, B. G.	..	..	..	..	..	..	..	..	1d. per lecture.
„	Smethwick N. S.	Simonx, Rev. T. G.	Young, Rev. J.	Sears, H.	..	..	..	..	..	..	..	..	1d. per nt.
Haslingden	Mech. Inst.	Whittaker, L.	Heap, B.	Shore, T. W.	18	25	7	..	3	1	..	..	2s. to 3s.
Hayfield (Stockport).	Birch Vale Inst.	Rodd, Rev. F. A.	Marsden, J.	Hurst, W.	..	..	..	..	..	..	..	..	2s.

Helston	Gram. Sch.	Penberthy, F.	Hosking, J. H.	Tyacko, W.	..	20	20	..	..	1	..	..	15s. ea. subj.
Hereford	*Blue Sch.*	*Anthony, C.*	*Budd, Rev. E. J. S.*	*Jeffery, W.*	..	..	..	..	..	..	..	..	6d. to 2s. 6d. per qr.
Hetton (Fence-houses)	Barrington Sch.	Wood, L.	Widowfield, F.	Rowden, W. T. Kernick, R.	..	88	88	..	..	14	..	..	Nil.
Heywood	Mech. Inst.	Fenton, A.	Fairbrother, G.	*Crawshaw, J.* *Duerr, G.*	44	18	..	26	8	2	..	..	2s. per qr.
Highgate	*Nat. Sch.*	*Dalton, Rev. C. B.*	*Smith, Rev. R. F.*	*Dronfield, J.*	..	..	..	..	..	..	..	..	4d. per wk.
Hingham (Norfolk)	Nat. Sch.	Tallent, J. T.	Hardinge, Rev. J. R.	Wilson, W. E. H.	..	22	22	..	..	..	..	..	1s. to 1s. 6d. per subj.
Holbeck (Leeds)	*Mech. Inst.*	*Ward, Rev. P.*	*Lister, C.*	*Tinker, H.* *Catton, E.*	..	..	..	..	..	..	..	..	3s. to 5s.
"	*Wes. Day. Sch.*	*Bunting, Rev. W.*	*Ellis, J.*	*Brears, W.*	..	..	..	..	..	..	..	..	Nil.
Holmfirth (Huddersfield)	*Wkg. Men's Club*	*Harpin, J.*	*Lomax, H.*	*Jarmain, G.* *Nettleton, W.* *Frost, J.*	..	..	..	..	..	..	..	..	5s.
Hornsey	*Brit. Sch.*	*Bird, H.*	*Maynard, R. R.*	*Leigh, S.*	..	..	..	..	..	..	..	..	1s. per mo.
Horwich (Bolton).	*Nat. Sch.*	*Pigot, Rev. H. S.*	*Evans, J.*	*Brown, T.*	..	..	..	..	..	..	..	..	5s.
Huddersfield	Mech. Inst.	Marriott, W.	Bate, J.	Jarmain, G. Nettleton, W. Kershaw, T.	28	60	37	..	9	13	..	..	9s. to 12s.
Huddersfield	*St. Paul's Sch.*	*Snowden, Rev. E.*	*Lawrence, Rev. G. G.*	*Brears, W.*	..	..	..	..	..	..	..	..	1s. to 2s. 6d.
"	*Mech. Inst., Milnsbridge.*	*Armitage, G.*	*Taylor, B.*	*Whiteley, H.*	..	..	..	..	..	..	..	..	2s. 6d.
Hull	Navigation Sch.	Whitaker, T.	Wilson, E. S.	Scaping, Z.	80	79	..	1	50	7	2 G. 1 S. 1 B.	1 G. 1 S.	Nil.
Hull	*People's Inst.*	*Bryson, J.*	*Raven, G.*	*Tinker, H.* *Read, J.* *Gill, H. S.*	..	..	..	..	..	..	..	..	5s. each subject.
"	*Day Street B. S.*	*Statham, Rev. W. M.*	*Stratten, T.*	*Spafford, W. A.*	..	..	..	..	..	..	..	..	4s.
Huntingdon	Walden's Sch.	Margetts, Rev. H.	Vesey, Rev. F. G.	Pascoe, J.	16	16	..	..	8	..	..	..	2s. 6d.
Hyde	Mech. Inst.	Thorneley, T.	Bradley, J.	Parnell, G. Taylor, T.	41	50	9	..	17	..	..	..	1s. each subject.
Ipswich	*Town Hall*	*Packard, E.*	*Drummond, H. P.*	*Vick, W.* *Griffiths, W. T.*	..	..	..	..	..	..	..	..	2s. 6d. per subject.
Jarrow-on-Tyne	*Mech. Hall and Inst.*	*McIntyre, J.*	*Wright, G.*	*Stokoe, R.* *Grice, J.* *Crawford, S.* *Wallbank, J.*	..	..	..	..	..	..	..	..	2s. 6d. to 5s.
Keighley	*Mech. Inst.*	*Holden, I.*	*Smith, S.*	*Stevenson, A.*	..	..	..	..	..	..	..	..	5s. ea. subj.
Kendal	Post-office Yd.-room	Whitwell, J., M.P.	Braithwaite, C., jun.	Prosser, W. Brown, J.	..	92	92	..	..	2	..	..	5s. to 21s.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
Kersley (Bolton).	Brit. Sch.	Fletcher, Rev. J.	Gee, S.	Collins, J.	..	14	14	..	..	..	..	..	Nil.
Kettering	North End N. S.	Lindsay, Rev. H.	Eldred, G.	Sturgess, W.	52	53	1	..	23	7	..	..	Nil.
"	Brit. Sch.	Toller, W.	Gotch, H. G.	Brooks, W. W.	..	36	36	..	..	1	..	..	Nil.
Kilburn	St. Mary's Schs.	Kennion, Rev. A.	Willis, W.	Kehde, H.	..	30	30	..	..	6	..	..	2s. 6d. to 5s.
Kinver	Wire Mill	Hodgson, Rev. J.	Bolton, Rev. W. H.	Packer, M. W.	25	18	..	7	5	..	..	..	2s. 6d. to 10s. 6d.
Kirkstall (Leeds).	*St. Stephen's Sch.*	*Tunstall, W.*	*Barrett, Geo.*	*Carr, G. S.*	..	..	..	..	..	..	..	..	10s. 6d.
Lamerton (Tavistock)	*School-room*	*Philpotts, Rev. H. J.*	*Sly, T.*	*Peddle, W. J.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Lamport (Northants).	Endowed Sch.	Isham, Sir C. E., Bt.	Curtis, W.	Graves, J. J.	..	53	53	..	..	..	..	..	Nil.
Lancaster	Mech. Inst.	Davis, Rev. D.	Gibson, T.	Prosser, W. Gregson, R.	48	80	32	..	9	10	..	..	1s. 3d. to 5s.
"	Sch. of Art	Lee, Rev. F. T.	Storey, W.	Gilbert, H.	..	12	12	..	..	4	..	..	10s. per yr.
Lancaster	*Boys' Nat. Sch.*	*Roper, W.*	*Seward, A.*	*Armstrong, J. N.*	..	..	..	..	..	..	..	..	1s.
Launceston	*Gram. Sch.*	*White, G. G.*	*Clarke, Rev. S. C.*	*Rowe, W.*	..	..	..	..	..	..	..	..	2s. 6d. to 10s.
Leeds	Mech. Inst.	Lucock, J. D.	Dayson, J. O.	Ward, G. Hick, T.	47	96	49	..	25	25	1 B.	2 S. 1 B.	5s. to 21s. per subj.
"	Sch. master's Class No. 1 and 2. *Sch. mistress' Cl.*	Heaton, J. D.	Sales, H. H.	Ison, E. Smith, W. Hick, T.	..	37	37	..	..	5	..	..	10s. per subject.
"	Y. M. Chr. Assoc.	Barran, J.	Smith, W. H.	Jefferson, S. Tiffany, J. B.	..	36	36	..	..	1	..	..	5s. per qr.
"	Wkg. Men's Inst.	Lupton, D.	Lupton, D., jun.	Brears, W.	..	17	17	..	..	1	..	..	2s. per qr.
"	St. Peter's Sch.	Woodford, Rev. J. R.	Wood, Rev. F. J.	Ison, E. Edge, H.	..	27	27	..	..	1	..	..	2s. 6d. to 3s. ea. subj.
Leeds	*Sch. of Art*	*Lucock, J. O.*	*Wardman, H.*	*Puckett, R. C.*	..	..	..	..	..	..	..	..	4s. per qr.
"	*Art and Sci. Inst.*	*Henderson, Rev. W. G.*	*Nussey, G. H.*	*Smith, W.* *Stevenson, A.* *Jarmain, G.* *Tinker, H.*	..	..	..	..	..	..	..	..	5s. to 21s. per subject.
"	*St. Mark's N. S.*	*Kettlewell, Rev. S.*	*Abbott, Rev. J. S.*	*Weaver, G.*	..	..	..	..	..	..	..	..	Nil.

"	*St. Simon's Sch.*	*Whitby, Rev. T.*	*Beverley, W. A.*	*Wright, G.*	..	..	..	..	..	..	..	..	1s.
"	*Hunslet M. I.*	*Blackburn, R.*	*Simpson, C.*	*Jefferson, S.*	..	..	..	..	..	..	..	..	5s. per sess.
Lees (Manchester)	Ch. Sch.	Higson, J.	Whittaker, Rev. R.	Kershaw, T. Lord, T.	33	35	2	..	11	6	..	..	7s.
Leicester	St. Martin's Sch.	Vaughan, Rev. D. J.	Bouser, Rev. J. A.	Atkins, E.	53	100	47	..	16	11	..	1 B.	2s. 6d. to 21s. each subject.
"	St. Margaret's N. S.	Jones, Rev. T.	Pertwee, Rev. A.	Padmore, S.	5	57	52	..	..	..	..	..	2s. 6d.
Leicester	*Great Meeting Sch.*	*Rowlett, W.*	*Kempson, W.*	*Hepworth, J.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
"	*Belgrave N. S.*	*Stephens, Rev. R.*	*Ellis, A.*	*Foister, J. S.*	..	..	..	..	..	..	..	..	1s. ea. subj.
Leigh (*Lanc.*)	*Pennington Ch. Ch. N. S.*	*Tunnicliffe, R.*	*Cronshaw, Rev. C.*	*Steeple, J.*	..	..	..	..	..	..	..	..	4s.
Leighton Buzzard (Beds.).	W. M. Mut. Imp. Soc.	Harris, T.	Page, W. S.	Lewis, E. W.	..	22	22	..	..	..	..	..	2s. 6d. to 10s.
Lewes	Sch. of Sci. and Art	Godlee, B.	De Putron, Rev. P.	Fisher, A.	..	10	10	..	..	..	..	..	2s. per mo.
Limehouse	*St. John's N. S.*	*Carr, Rev. C. H.*	*Ogle, Rev. J. L.*	*Murché, V. T.*	..	..	..	..	..	..	..	..	1s.
Lincoln	Trg. Coll.	Jarvis, J. K.	Blenkin, Rev. F. B.	Nelson, Rev. H.	..	45	45	..	..	1	..	..	Nil.
Lincoln	*Sch of Art*	*Ruston, J.*	*Gibney, Rev. J. S.*	*Taylor, E. R.*	..	..	..	..	..	..	..	..	2s. 6d. per month.
Lindley (*Huddersfield*)	*Mech. Inst.*	*Town, Rev. J. W.*	*Brook, J. W.*	*Knowles, M.*	..	..	..	..	..	..	..	..	1d. per wk. to 3s. 6d. course.
"	*Nat. Sch.*	"	"	"	..	..	..	..	..	..	..	..	1d. per wk. or 3s. 6d. session.
Liskeard	*Lit. Inst.*	*Isaac, J. C.*	*Jewell, C. W.*	*Corin, W. J.* *Rider, A. J.*	..	..	..	..	..	..	..	..	4s. each subject.
Littleborough (*Rochdale*)	*Church Sch.-room*	*Carter, Rev. T.*	*Winterborn, Rev. B. T.*	*Allberry, E.*	..	..	..	..	..	..	..	..	3s.
Liverpool	Sci. Sch. Free Liby.	Lamport, W. J.	Gregson, S. L.	Carter, W. Watt, J. Hayes, J.	60	130	70	..	18	16	..	..	Total amt. 40l. 5s. 8d.
"	Institute	Holt, P. H.	Sharp, C.	Adair, S. Ewart, E. B. Lander, G. Lewis, J. T.	107	150	43	..	38	34	..	1 G. 2 B.	3s. per qr. to 10s. 6d. per sess.
Liverpool	*Trg. Coll., Mount Pleasant*	*Stokes, S. N.*	*Guy, Rev. R. E.*	*Lomax, Miss* *McGarvie, Miss*	..	..	..	..	..	..	..	..	Nil.
Llanboidy (*St. Clears*).	*Nat. Sch.*	*Powell, W. R. H.*	*Owen, S.*	*Duckett, J. B.*	..	..	..	..	..	..	..	..	1s. to 5s.
Llanelly	Copper Wks. Sch.	Nevill, C. W.	Morgan, R.	Jones, J. Rees, W. Jones, A.	73	88	15	..	28	15	..	..	2s. to 3s. per subject.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
Llanelly	*Loughor N. S.*	*Williams, E.*	*Jenkins, Rev. E.*	*Smith, A.*	..	..	..	..	..	..	..	..	2s. ea. subj.
London:—													
Battersea	Trg. Coll.	MacCarthy, Rev. J.	Dugard, F.	Faunthorpe, Rev. J. P.; Roberts, G.	80	80	..	..	98	17	1 G. 1 S.	..	1s. each subject.
"	Christ Ch. Sch.	"	Forster, Rev. G. W.	Brown, H.	..	56	56	..	..	1	..	..	1s.
Battersea	*St. John's N. S.*	*Thompson, Rev. E.*	*Hatcher, W. H.*	*Annis, S.*	..	..	..	..	..	..	..	..	5s.
"	*Class Room Wes. Chapel.*	*Kelly, Rev. C. H.*	*Molineux, J.*	*Tyrer, T.*	..	..	..	..	..	..	..	..	2s. 6d. to 5s.
Bayswater	*St. Matthew's P. S.*	*Hunter, Ven. Arch.*	*Lovely, Rev. G.*	*Ricks, G.*	..	..	..	..	..	..	..	..	Nil.
Bermondsey	Christ Ch. Sch.	Martin, Rev. R. M.	Shaw, F.	Child, T.; Jones, T.	22	12	..	10	4	4	..	..	5s.
Bethnal Green	Birkbeck School, Cambridge Rd.	Rogers, Rev. W.	Runtz, G.	Pike, R. W.; Bithell, R.; Hughes, W. H.; Heney, J.	106	132	26	..	33	4	..	..	1s. to 2s. 6d. ea. subj.
"	Nat Sch., Church Row	Hansard, Rev. S.	Avenell, W. C.	Simpson, B.; Moss, H.; Lovell, A.; Payne, J.; Angel, H.	115	144	29	..	13	10	..	..	5s. adults, 2s. boys.
Bethnal Green	*St. James the Less N. S.*	*Moon, Rev. G.*	*Dixon, T.*	*Lowres, J.*	..	..	..	..	..	..	..	..	1s. per mo.
"	*Abbey Street Sch.*	*Buxton, E. N.*	*Reeve, T. F.*	*Crouch, W.*	..	..	..	..	..	..	..	..	6d. ent. fee.
Blackfriars Road	South London Wkg. Men's Coll.	Huxley, T. H.	Rossiter, W.	Bithell, Dr.; Hulme, F. E.; Mitchell, C. T.; Tyssen, A. D.	..	29	29	..	..	..	..	..	3s. 6d. to 5s. ea. subj.
Borough Rd.	Trg. Coll.	Owen, H.	Bourne, S.	Curtis, J. C.; Smith, A. F.; Barkby, E.; Langton, J.	69	159	90	..	98	25	..	..	Nil.
"	Model Sch.												
Brixton Hill	Wkg. Men's Club	McArthur, W., M.P.	Gibbons, G.	Bradbury, A. A.	9	20	11	..	8	3	..	..	5s. ea. subj.
Camberwell	*St. Matthews' Inst.*	*Flindt, Rev. G. K.*	*Bates, A.*	*Parry, P.*	..	..	..	..	..	..	..	..	7s. 6d.

Charterhouse	*St. Thomas' Sch.*	*Rodgers, Rev. J.*	*Uridge, W.*	*Parker, J.*; *Simpson, B.*	..	..	..	..	..	..	..	..	5s.
Chancery Lane	Birkbeck Lit. Inst.	Campbell, D.	Knott, J. W.	Vaughan, W.; Hopper, T.; Chaloner, G.; Davy, W.; Wilson, W. J.; Zerffi, G. G.	..	47	47	..	..	1	..	..	1s. to 5s. per qr.
Chelsea	St. Mark's Coll.	Batty, Rev. W. E.	Quilter, J. S.	Eastburn, Rev. C. F.; Byatt, H.; Dawe, Rev. C. S.; Lawson, W.; Atkins, G.	48	79	31	..	62	14	..	..	Nil.
"	*College St. Tech. Sch.	Dilke, Sir C. W., Bart., M.P.	Demaus, Rev. R.	Bickerton, A. W.; Davies, S. W.; Coles, H. J.; Turner, H.; Ewings, J.; Ashby, J.; Jackson, G.	153	177	24	..	46	27	1 S. 1 B.	1 S. 1 B.	2s. 6d. to 7s. 6d.
City Rd., E.C.	*Finsbury Coll.*	*M'Auslane, Rev. A.*	*Skuse, W. H.*	*Bond, G.*	..	..	..	..	..	..	..	..	2s. 6d.
Clapham	*Christ Church Sch.*	*Abbott, Rev. B.*	*Helps, Rev. W. S.*	*Annis, S.*	..	..	..	..	..	..	..	..	5s.
"	*St. James' Sch.*	*Price, Rev. A. C.*	*Wainwright, W.*	*Taylor, W.*	..	..	..	..	..	..	..	..	4s.
Clerkenwell	*Technical Sch.*	*Pratt, H.*	*Taylor, J.*	*Bickerton, A. W.*; *Coles, H. J.*	..	..	..	..	..	..	..	..	3s. 6d.
"	*St. Peter's N. S.*	*Sharp, Rev. B. O.*	*Wednell, A. C.*	*Swanson, W.*; *Nankivell, G.*	..	..	..	..	..	..	..	..	5s.
Eaton Square	*St. Peter's Coll. Sch.*	*Samuelson, W.*	*Pococke, H.*	*Gibsone, Rev. B. W.*; *Gwinnell, W. F.*	..	..	..	..	..	..	..	..	Not yet arranged.
Edgeware Rd.	*Christ Chapel N. S.*	*Campe, Rev. C.*	*Randall, E. B.*	*Simpson, B.*	..	..	..	..	..	..	..	..	Nil.
Goswell Road	St. Barnabas' Sch.	Ward, Rev. H.	Carter, J. H.	Conning, J.; Jones, T.	..	27	27	..	..	1	..	..	5s.
Grays Inn Rd.	St. Bartholomew's Sch.	Bird, Rev. R. J.	Dove, K.	Town, E. H.	..	80	80	..	..	25	..	..	1s.6d. per qr.
Hackney	St. Thomas Sq. Sch.	Picton, Rev. J. A.	Reynolds, A. W.	Bond, G.; Weston, H.; Ricks, G.; Moss, H.	48	141	93	..	12	4	..	..	1s. to 2s. 6d.
Hackney (South)	*Parochial Sch.*	*Lockwood, Rev. G. P.*	*Wilkie, G. F.*	*Weston, H.*; *Tremeer, C.*; *Weston, Mrs. H.*	..	..	..	..	..	..	..	..	1s. ea. subj.
Hackney	*Parish Sch., Paradise Place.*	*Goodchild, Rev. T. O.*	*Baker, Rev. C. W.*	*Byatt, H.*	..	..	..	..	..	..	..	..	7s. 6d.
Hampstead Rd.	*St. James' N. S.*	*Hodson, Rev. C. W.*	*Thompson, Rev. G.*	*Hardy, J.*	..	..	..	..	..	..	..	..	2s.6d. ea. sub.
Haverstock Hill	*Orphan Wkg. Sch.*	*Smith, B. W.*	*Tyler, C.*	*Longstaff, J. W.*	..	..	..	..	..	..	..	..	Nil.

* Removed from Arthur Street.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
London—*cont.* Islington, Lower	Public Sch.	Fleming, Rev. W.	Wheatley, H. J.	Howard, J.; Angel, H.	145	185	40	..	38	14	..	..	4s. to 7s. 6d.
Islington	*Youth's Inst., St. George's Hall*	*Faithfull, W.*	*Tabrum, B. J.*	*Fairmaner, W.*	..	..	..	..	..	..	..	..	4d. pr. wk. or 3s. per session.
"	*St. Thomas', Everilda St.*	*Allen, Rev. G.*	*Allen, C. J.*	*Meyer, C.; Speer, G.; Fairmaner, W.; Hardy, J.*	..	..	..	..	..	..	..	..	3s.
"	*Wes. Sch.*	*McKenny, Rev. J.*	*Love, R. H.*	*Busbridge, W.; Yearsley, O.; Cleminson, J.*	..	..	..	..	..	..	..	..	5s.
Kensington	*School, Allen St.*	*Stoughton, Rev. J.*	*Trotman, S. H.*	*Bickerton, A. W.; Turner, H.; Coles, H. J.*	..	..	..	..	..	..	..	..	3s. 6d.
Kentish Town	Gospel Oak Sch.	Lee, Rev. C.	Wildy, A. S.	Weston, H.; Teather, H. W.; Feltham, E.	..	87	87	..	..	..	..	..	1s. ea. subj.
Kingsland	*Sch. of Art*	*Aveling, Rev. T.*	*Iliffe, W.*	*Swinstead, C.*	..	..	..	..	..	..	..	..	Nil.
Knightsbridge	Albert W. M. Club	(Included with College Street, Chelsea).											
Lambeth	Hercules Buildings	Lingham, J.	Jones, W. W.	Heller, T. E.; Child, T.; Young, G.; Browne, L.; Browne, E. L.; Groom, J. B.; Jones, T.; Furness, J.	155	209	54	..	13	..	1 S., 1 B.	..	5s. per sub.
"	Sch. of Art and St. Peter's Sch.	Gregory, Rev. G.	Herbert, Rev. G. W.	Sparks, J.; Bale, E.; Jennings, J.; Schenk, R.; Hayes, G.	..	36	36	..	..	8	..	..	1s. per mo. each subj.
Lambeth	*Lambeth Baths*	*Murphy, Rev. G. M.*	*Pamacott, A.*	*Ellis, A.; Morley, J.; Sadler, A.*	..	..	..	..	..	..	..	..	5s.

„	*Wes. Sch.*	*Simmonds, J.*	*Wheeler, T.*	*O'Leigh, R.*	..	..	..	..	..	..	..	..	1*d.* pr. week.
Leadenhall St., E.C.	City of London Coll.	Mackenzie, Rev. C.	Hansen, H. W.	Maxwell, T.; Hawker, G.; Northey, J.; Jewesbury, F. N.; Adams, H.	30	46	16	..	..	1	..	..	5*s.* to 10*s.* each subj.
Long Acre	Wilson Street Sch.	Whitmore, Rev. C. J.	Madden, B.	Duffy, F. P	..	19	19	..	..	..	..	..	6*s.*
Marylebone	Central Sch.	Eyre, Rev. C. P.	Goody, Rev. C. J.	Ricks, G.; Wren, J.; Baker, A.	48	86	38	..	2	1	..	..	1*s.* ea. subj.
„	New Quebec Club and Inst.	Fremantle, Rev. W. H.	Pope, F.	Dorrell, C. F.	..	28	28	..	..	1	..	..	5*s.*
Nine Elms	Lecture Room	Mather, Rev. W. M.	Sellar, F.	Bickerton, A. W.; Davies, S. W.; Jackson, G.	..	37	37	..	..	6	..	..	3*s.* 6*d.*
Notting Hill	*St. James' Square Tabernacle Sch.*	*Varley, Rev. H.*	*Day, W.*	*Barber, W. C.*	..	..	..	..	..	..	..	..	5*s.*
Old Kent Rd., S.E.	*St. Mary's Sch.*	*Snape, Rev. A. W.*	*Walsh, Rev. J. F. B.*	*Simpson, B.*	..	..	..	..	..	..	..	..	General sch. fee.
Paddington	Greville House	Merivale, J. L.	Deans, C.	Jones, T.; Bray, G.	31	48	17	..	10	6	..	..	Not yet fixed.
Paddington	*All Saints' N. S.*	*Steventon, Rev. E. H.*	*Mercer, Rev. W.*	*Ricks, G.*	..	..	..	..	..	..	..	..	Nil.
Peckham	*St. Mary's Coll.*	*Biggs, Rev. M.*	*Fry, F. W.*	*Bickerton, A. W.*	..	..	..	..	..	..	..	..	Nil.
Pimlico	*St. Saviour's Sch.; St. Gabriel's Sch.*	*Belcher, Rev. B.*	*Severn, W.*	*Annis, S.*	..	..	..	..	..	..	..	..	7*s.*
Poplar	Boys' Nat. Sch.	Nowell, Rev. T. W.	Fairbairns, W.	Gase, E. H. J.; Saunders, J.	..	30	30	..	..	5	..	..	6*s.*
Poplar	*William St.*	*Walter, Rev. R. P.*	*Paton, Rev. J.*	*Wild, R.*	..	..	..	..	..	..	..	..	5*s.*
Regent Street	Royal Polytechnic	Mackenzie, Rev. C.	Cousens, J.	Hardy, J.; Downar, G. F.	46	55	9	..	19	7	1 G.; 1 S.; 3 B.	..	7*s.* 6*d.* to 15*s.* each subject.
St. John's Wood.	*Boys' Cath. Sch.*	*Mostyn, L.*	*Burke, Rev. W.*	*Carroll, J.*	..	..	..	..	..	..	..	..	2*s.*
Somers' Town	*Christ Ch. Nat. Sch.*	*Worsfold, Rev. T. N.*	*Maney, C.*	*Parry, P.*	..	..	..	..	..	..	..	..	5*s.*
„	*Brit. Sch.*	*Thorold, Rev. A.*	*Leftwich, H. T.*	*Busbridge, W.; Clark, C.; Ellercamp, H.; Newman, G.; Topple, C. J.*	..	..	..	..	..	..	..	..	5*s.*
Southwark	Nat. Sch., Swan St.	Moullin, Rev. D. A.	Bayles, W. J.	Parry, P.; Adams, H.	..	24	24	..	..	..	..	..	7*s.* 6*d.*
Spitalfields	*Sch. of Art*	*Vanner, J.*	*Hill, N.*	*Mills, S. F.; Rawson, W.*	..	..	..	..	..	..	..	..	2*s.* 6*d.* per month.
Tottenham Court Rd.	*St. John's W. M. I.*	*Coxhead, Rev. J. J.*	*Charlton, Rev. H. B.*	*Conning, J.; Browne, L.*	..	..	..	..	..	..	..	..	2*s.* to 4*s.* per subjt.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
London—*cont.*													
Vauxhall	L. and S. W. Rail. Inst., Brunsw. Ho.	Shepherd, Rev. C. P.	Grimsdick, C.	Parry, P.	..	10	10	..	..	3	..	..	5s. 6d. to 8s.
"	Baptist Sch.	Lawrence, Sir J. C., M.P.	Hearson, Rev. G.	Busbridge, W. Clark, C. Cleminson, J. Newman, G.	..	45	45	..	..	5	..	..	5s.
Walham Green.	*St. John's Sch.*	*Batty, Rev. W. E.*	*Godrich, T.*	*Lawson, W.*	..	..	..	..	..	..	..	..	Nil.
Wandsworth	R.P. Fund, Boys' Sch.	Lindsay, General Hon. J.	Mugford, W. H.	Bickerton, A. W. Turner, H. Pomeroy, P. T. Hart, J.	..	57	57	..	..	..	..	..	Nil.
Waterloo Road	Church St. Nat. Sch.	Johnston, Rev. J. A.	Quaif, W.	Busbridge, W. Norman, C. Thompson, R.	30	88	58	..	63	26	..	..	5s.
Westminster	Wes. Trg. Coll.	Hall, T. F.	Olver, Rev. G. W.	Sugden, W. Kinton, J. L. Langler, J. R. Mansford, C.	29	94	65	..	28	25	..	..	Nil.
"	St. James the Less	Dickson, Rev. G. D. W.	Giveen, Rev. R. L.	Busbridge, W. Yearsley, O. Ellercamp, H.	..	41	41	..	..	11	..	..	5s.
Westminster	*Wkg. Men's Club*	*Maskell, Rev. J.*	*Payne, J.*	*Bickerton, A. W.* *Turner, H.* *Davies, S. W.*	..	..	..	..	..	..	..	..	Nil.
Luddenden Foot (Halifax)	Cong. Sch. Room	Whitworth, W.	Hillman, Rev. S. D.	Tattersall, A.	..	38	38	..	..	1	..	..	5s.
Lutterworth	*Cottage Sch.*	*Constable, Rev. J. P. G.*	*Tomlinson, Rev. R.*	*Bellow, Rev. W.* *Fowler, J.*	..	..	..	..	..	..	..	..	6d. to 9d. per mnth.
Macclesfield	Modern Free School	- - -	Brooker, J.	Jackson, J.	48	48	..	..	..	..	..	..	10s. per qr.
Manchester	Mech. Inst.	Grave, J.	Shipley, G. H.	Brewer, R. F. Mellor, J. Tomkins, E. Gee, W. Richardson, H. Richardson, J. Davenport, T.	200	240	40	..	64	21	1 G. 1 S. 2 B.	3 G. 1 S. 3 B.	6d. per qr. to 1s. per session.

„	Roby Educ. Soc.	Booth, G.	Ellis, R. P.	Schofield, J.	39	12	..	27	9	2	..	..	3s. per qr.
„	Hulme W. M. Inst.	Booth, W.	Letch, G. A.	Richardson, J. Richardson, H. Jones, T.	31	38	7	..	13	4	..	..	1s. ea. subj.
„	St. George's Nat. Sch.	Lindsay, Rev. T.	Gregory, J.	Monks, P.	13	10	..	2	1	..	..	..	2s. ea. subj.
Manchester	*Owen's Coll. and Mech. Inst.*	*Rumney, R.*	*Lawton, T.*	*Angell, J.* *Spriggs, C.* *Bentley, A. W.* *Thorpe, Dr.*	..	..	..	..	..	..	..	..	4s.
„	*Free Gram. Sch.*	*Armitage, Sir E.*	*Hodson, S. H.*	*Angell, J.* *Watts, W. M.* *Aldis, T. S.* *Pritchard, Z.*	..	..	..	..	..	..	..	..	Included in general school fee.
„	*Buildg. Trades Inst.*	*Huntingdon, Rev. W.*	*McLean, J.*	*Battye, J.* *Bennion, J. A.* *Haslam, W.*	..	..	..	..	..	..	..	..	2s. 6d. per quarter.
„	*Pres. Sch., Ancoats*	*Rose, Rev. J. M.*	*Carson, A.*	*Richardson, H.* *Hurst, W.*	..	..	..	..	..	..	..	..	5s. each subject.
„	*Rusholme Pub. Hall*	*Mayson, J. S.*	*Wilde, E.*	*Monks, P.*	..	..	..	..	..	..	..	..	6s. per sess.
„	*St. Luke's School, Cheetham Hill Rd.*	*Chippendall, Rev. J.*	*Guest, Rev. T. H.*	*Napper, E. W.*	..	..	..	..	..	..	..	..	2s. 6d. per session.
Market Harborough	*Nat. Sch.*	*Follett, Rev. W. W.*	*Martin, W.*	*Price, W.*	..	..	..	..	..	..	..	..	1s. 6d. per term.
„	*Brit. Sch.*	„	„	*Robinson, A.*	..	..	..	..	..	..	..	..	1d. pr. night.
Marple (Stockport).	*Albert Sch.*	*Turner, W. H.*	*Walmsley, W.*	*Walker, J.*	..	..	..	..	..	..	..	..	Nil.
Melksham (Wilts).	*Brit. Sch.*	*Gore, A.*	*Palmer, T., jun.*	*Price, H. S.*	..	..	..	..	..	..	..	..	1s. to 2s. 6d.
Meltham, Huddersfield.	*Church Sch.*	*Watson, Rev. E. C.*	*Armitage, A. C.*	*Revell, W.*	..	..	..	..	..	..	..	..	2s. 6d.
Melton Mowbray.	Church School-room	Colles, Rev. W. M.	Willcox, W.	Greasley, J.	3	10	7	..	..	..	..	..	5s. per qr.
Merthyr-Tydfil	*Tydfil Sch.*	*James, C. H.*	*Johnstone, Rev. F. S.*	*Williams, E.* *Heasley, R.*	..	..	..	..	..	..	..	..	1s. per mo. to 7s. 6d. per sess.
Middlesborough.	Church Association	Smith, Rev. A. C.	Blair, Rev. G. A.	Stead, W.	11	8	..	3	8	3	..	..	5s.
Middleton	National Sch.	Durnford, Ven. R.	Ward, Rev. C. B.	Wheeler, G. H.	22	35	13	..	17	1	1 B.	..	2s. 6d. ea. subject.
Middleton	*Parkfield, Holy Trin., C. N. S.*	*Jackson, T.*	*Bates, Rev. E.*	*Heywood, E.*	..	..	..	..	..	..	..	..	2s. 6d.
Millwall	Pres. Inst.	Dickson, Rev. J. H.	- - -	Farncombe, F.	..	16	16	..	..	..	..	..	4s.
Mirfield, (Dewsbury)	*Lit. Soc.*	*Johnson, J. M.*	*Barker, J.*	*Jarmain, G.* *Snaith, W. A.*	..	..	..	..	..	..	..	..	5s.
Morley (Batley).	*Brit. Sch.*	*James, Rev. J.*	*Smith, W.*	*Harries, R. E.*	..	..	..	..	..	..	..	..	1s.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
Mossley (Manchester)	Mech. Inst.	Jones, Rev. G. A.	Jackson, T.	Lord, T. Mirshull, W. H.	23	23	..	..	2	2	..	..	3*s.* ea. subj.
Moulton (Northampton).	*Nat. Sch.*	*Nethercote, H. O.*	*Sanders, Rev. T.*	*Onn, W.*	..	..	..	..	..	..	..	..	1*d.* pr. wk. to 6*d.* per month.
Mow Cop (Stoke-on-Trent).	*Nat. Sch.*	*Robinson, Rev. J. J.*	*Jamieson, W.*	*Hodgins, B.*	..	..	..	..	..	..	..	..	2*s.* 6*d.* half-yearly.
Murton	Colliery Sch.	Waters, Rev. R.	Archbold, J. W. M.	Bowden, W. T. Kernick, R.	..	52	52	..	..	11	..	..	5*s.*
Nailsworth (Stroud)	Nat. Sch.	Stokes, T.	Thomas, E. T. W.	Smith, P. L.	..	8	8	..	..	1	..	..	1*s.* 6*d.* ea. subject.
Nelson in Marsden	Lomeshaye Schs.	Boroyd, W.	Waddington, J.	Thompson, J. Ashworth, J.	36	35	..	1	23	..	..	..	1*s.*
Newark-on-Trent	Mech. Inst.	Godfrey, T. S.	Lammin, H.	Webster, J. H. Turnbull, J.	34	31	..	3	3	1	..	..	2*s.* 6*d.* ea. subject.
Newcastle-on-Tyne	Elswick Mech. Inst.	Maughan, Rev. W.	Allan, G.	Bowden, W. T. Kernick, R. Cail, C. Clark, W. N. Pratt, R. Garthorne, M. Hutchinson, G. H.	..	117	117	..	..	38	..	..	6*s.* per sess.
"	Mech. Inst.	Gregson, J. L.	McKendrick, J.	Ross, J. A. G.	..	16	16	..	..	2	..	..	5*s.* ea. subj.
Newcastle-on-Tyne	*Stephenson Inst. Wellingt. Quay*	*Potter, A.*	*Goddard, A.*	*Stokoe, R.* *Crawford, S.* *Grice, J.*	..	..	..	..	..	..	..	..	5*s.*
"	*Sch. of Art*	*Watson, J.*	*Leathart, J.*	*Way, W. C.* *Harrison, W.*	..	..	..	..	..	..	..	..	2*s.* 6*d.* per month.
Newcastle-under-Lyme.	*Sch. of Art*	*Broad, Rev. J. S.*	*Earl, E.*	*Bacon, J. P.*	..	..	..	..	..	..	..	..	2*s.* per subj.
Newton Heath (Manchester).	All Saints (No. 2) Sch.	Hutchinson, Rev. W.	Hudson, T.	Parnell, G.	18	18	..	..	5	1	..	..	5*s.*

Northallerton	*Institute*	*Mercer, Rev. T. W.*	*Loane, A. W.*	*Walton, J. S.* *Jackson, W.*	..	..	..	..	..	..	..	..	Nil.
Northampton	Museum, St. Giles' Square	Compton, Rev. Lord A.	Hensman, J. B.	Lees, C. Coleman, J. B.	115	191	76	..	30	12	1 B.	1 B.	From 6d. per mo. ea. subj. to 5s. per sess.
Northampton	*St. Sepulchre's N. S.*	*Butlin, Rev. W.*	*King, C. D.*	*Smart, H.*	..	..	..	..	..	..	..	..	6d. per mo.
North Ormesby	Church Inst.	Pennyman, J. S.	Sharrock, Rev. W. R.	Weatherill, R. Casson, T.	7	5	..	2	4	..	..	..	2s. 6d.
North Shields	*Free Library*	*Shotton, E.*	*Edington, J. S.*	*Wheatley, M. J.* *Lambton, J. W.* *Proctor, H. R.*	..	..	..	..	..	..	..	..	5s. to 10s. 6d. each subj.
"	*St. Peter's Sch.*	- - - -	*Hicks, H.*	*Stokoe, R.* *Crawford, S.* *Bewick, T.*	..	..	..	..	..	..	..	..	5s.
Norwich	*Presbyterian Sch.*	*Smyth, Rev. J. D. H.*	*Freeman, J.*	*Pinder, T. R.* *Claxton, R. L.* *Taylor, J. E.* *Gogge, R. G.* *Wright, J. D.*	..	..	..	..	..	..	..	..	1s. to 5s.
Norwich	Thorpe Hamlet N. S.	Owen, Rev. S. J.	Caley, J. W.	Marsh, W. H.	..	8	8	..	..	..	..	..	2s. 6d. to 5s.
Nottingham	Mech. Inst.	Morse, Rev. F.	Thurlow, R.	Wilson, E. Major, H. Elder, G. Smith, G. E. Taylor, W.	61	232	171	..	17	4	..	..	2s. to 10s.
Oadby (Leicester).	*Nat. Sch.*	*Gordon, Rev. T. W. W.*	*Lee, Rev. W. H.*	*Hoyle, W. H.*	..	..	..	..	..	..	..	..	1s.
Oldbury	Nat. Sch.	Taylor, Rev. W. T.	Gill, J.	Spencer, P.	61	68	7	..	12	1	..	..	1d. per night or 4d. week.
"	Messrs. Chance's Inst.	Chance, H.	Chance, A. M.	Horton, F. C.	14	76	62	..	..	..	..	..	3s. ea. subj.
Oldham	Sci. and Art Sch.	Platt, J., M.P.	Bailey, T.	Phythian, J. P. Philip, J. Walters, C.	80	98	18	..	42	13	..	1 S.	7s. 6d.
"	Glodwick Inst.	Harrop, E.	Green, J.	Kershaw, T.	30	76	46	..	14	8	..	..	5s.
"	Analytic Lit. Inst.	Yates, J.	Hall, R.	Taylor, W. Haslam, W.	44	40	..	4	16	13	..	..	6d. per mo. 2s. per qr.
"	Mech. Inst., Werneth	Taylor, J.	Mellor, W.	Mellor, J.	33	34	1	..	14	1	..	..	1s. 6d. per qr.
Openshaw	Ashbury Carriage Works	Airey, Rev. J. P.	Ashbury, T., jun.	Tomkins, E. Tomkins, W.	..	29	20	..	..	9	..	..	5s.
"	Wes. Sch.	Tyler, Rev. G.	Kay, J., jun.	Hurst, W.	..	30	30	..	..	..	..	..	2s. 6d. ea. sub.
Oswaldtwistle (Blackburn).	*Wes. Schs.*	*Holbrey, Rev. G.*	*Grimshaw, W.*	*Hargreaves, W.*	..	..	..	..	..	..	..	..	1s. 6d. per season.
Oswaldtwistle	*Busk Sch.*	*Underwood, Rev. W. J.*	*Smith, J.*	*Lucas, J.*	..	..	..	..	..	..	..	..	6d. per mo.
Oundle (Northants).	*Brit. Sch.*	*Siddons, G.*	*Hill, J.*	*Roe, R. G.*	..	..	..	..	..	..	..	..	1s. to 2s. 6d.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
Oxford / *Oxford*	University Museum, Art Sch. and *Wes. Sch.*	Liddell, Very Rev. H. G.	Alden, E. C.	Gubb, E. J.; Richardson, J.; Eagleston, J.; Macdonald, A.	..	17	17	..	..	7	..	..	5s. to 10s. per subj.
Padiham	Nat. Sch.	Fox, Rev. J. H.	Bussell, Rev. F. V.	Thompson, J.	10	11	1	..	9	..	..	..	Nil.
Padiham	*Wes. Sch.*	*Kent, Rev. R. B.*	*Stephenson, W.*	*Hargreaves, W.*	..	..	..	..	..	..	..	..	Nil.
Patricroft (Manchester)	Mech. Inst.	Wilson, R.	Hewitt, J.	Tomkins, E.; Tomkins, W.; Slater, J. K.	27	18	..	9	17	8	1 S. 1 B.	2 G., 1 B.	2s. to 4s. 6d.
Pavenham	Ch. of Eng. Sch.	Tucker, J.	Ram, Rev. S. J.	Glover, A. W	..	19	19	..	..	1	..	..	1s. ea. subj.
Pembroke Dock	Mech. Inst.	Cocks, J.	Sinnette, G. M.	Fitze, W. J.	..	15	15	..	..	..	..	..	5s. to 10s.
Pendeen (Penzance).	Nat. Sch.	Aitken, Rev. R.	Bennetts, J.	Oats, F.	..	7	7	..	..	..	..	..	2s. 6d. to 5s.
Pendleton (Manchester).	Mech. Inst.	Barrett, R. H.	Whitehead, A. H.	Beever, J.	20	19	..	1	4	2	..	..	2s. 6d. each subject.
Penzance	Sch. of Art	Downing, N. B.	Rodd, W. H.	Geoffroi, H. M.; Bettany, G.	24	28	4	..	4	8	..	..	Nil.
Penzance	*Sancreed N. S.*	*Pascoe, H.*	*Collyns, J. M.*	*Cridland, T.*	..	..	..	..	..	..	..	..	5s. per sess.
Peterborough	Trg. Coll.	Skrimshire, Rev. A.	Savigar, J.	Tomlinson, J.; Girling, R. G. S.	..	37	37	..	..	2	..	..	4s. 6d. ea. subject.
Pitsford (*Northants*).	*Nat. Sch.*	*Markham, H. P.*	*Evans, Rev. J. M.*	*Carter, G.*	..	..	..	..	..	..	..	..	2s. to 2s. 6d.
Plumstead	Burrage Road	McAlister, Rev. J. A.	Hammond, J.	Shipman, C.; Downar, G. F.; Farlie, J. L.; Williams, R.; Jones, T.	57	85	28	..	58	15	..	1 G., 1 S.	5s. to 10s.
Plumstead (*Kent*)	*St. James' Sch.*	*Robertson, Rev. A.*	*Raynes, A. T.*	*Busbridge, W.*; *Hopper, T.*; *Ellis, A.*; *Charlesworth, T.*	..	..	..	..	..	..	..	..	5s.
Plymouth	Courtenay Street	Bate, C. S.	Cawse, J. H. M.	Merrifield, J.; Rickard, G.; Rider, A.; Balkwill, F. P.; Hodge, H.; Sargent, R. E.; Shopland, S.; Hingston, C. A.	163	141	..	22	81	40	1 G. 3 S. B. 4	1 B.	2s. 6d. ea. subject.

"	Navigation Sch.	Hill, R.	Cuming, W. B.	Merrifield, J.	344	241	..	108	..	1	..	..	1s. per wk.
"	Charles Nat. Sch.	Greaves, Rev. H. A.	Cuddeford, T.	{ Evers, H. Evers, H. G. Bowden, J. T. Clark, R. G. }	..	74	74	..	..	15	..	..	{ 2s. 6d. per quarter. 1s. per term.
Portland	Grove Sch.	Clifton, G.	Hill, Rev. A.	Moore, E. W.	30	23	..	7	2	..	..	..	Nil.
Portsmouth	*Nat. Sch.*	*Grant, Rev. E. P.*	- - -	{ *Horn, H.* *Rockett, J. R.* *Lawe, J.* }	..	..	..	..	..	..	..	..	{ 2s. per mo. each subj.
Preston	Inst., Avenham	Myres, J. J.	Newsham, W.	{ Cope, J. G. Gilbert, H. }	57	79	23	..	30	13	1 S., 1 B.	1 S.	3s. to 10s.
Queensbury (Halifax).	*Nat. Sch.*	*Foster, W.*	*Hyatt, Rev. J. C.*	*Harrison, J.*	..	..	..	..	..	..	..	..	5s.
Rawtenstall	Mech. Inst.	Whitehead, J. B.	Wardleworth, W.	{ Tomkins, E. Tomkins, W. }	55	41	..	14	33	14	..	..	4s.
"	Irwell Inst.	Ashworth, R.	Ashworth, H. H.	Thornley, G.	..	12	12	..	..	..	..	..	1s.
Reading	*Sch. of Art*	*Taylor, J. O.*	*Brown, W.*	*Havell, C.*	..	..	..	..	..	..	..	..	5s.
Redditch	Lit. Inst.	Bartleet, R. S.	Sparrow, S.	Bryant, J. E.	..	40	40	..	..	..	..	..	{ 1s. 6d. per quarter.
Redruth	The Institute	Mitchell, T.	Grylls, W. M.	Pender, W.	10	54	44	..	2	..	..	..	2s. 6d.
Retford	*Wes. Day Sch.*	*Midgeley, Rev. J.*	*Liller, W.*	*Reatchlous, H. N.*	..	..	..	..	..	..	..	..	{ 2d. and 3d. per week.
Richmond (Surrey).	*Petersham Brit. Sch.*	*Nott, Rev. P. W.*	*Blyth, Rev. F. C.*	*Smith, E. W.*	..	..	..	..	..	..	..	..	2s. 6d.
Riddings (Derbysh.)	Mut. Imp. Soc.	Walsh, Rev. T. H.	Wood, S. A.	{ Fowler, J. Pine, W. F. Booth, J. }	..	38	38	..	..	..	..	1 B.	Nil.
Ripon	*Female Trg. Coll.*	*Hedley, Rev. T.*	*Ward, Rev. J. M.*	*Mustard, Miss*	..	..	..	..	..	..	..	..	Nil.
Rochdale	Brit. Sch.	Mansell, G.	Belmont, E.	{ Tomkins, E. Tomkins, W. Duerr, G. Wheeler, G. H. }	47	114	67	..	18	27	..	1 B.	6s.
Rothwell (Kettering).	*Brit. Sch.*	*Hafford, C.*	*Palmer, C.*	*Brooks, W. W.*	..	..	..	..	..	..	..	..	Nil.
Rowley Regis (Dudley).	*Nat. Sch.*	*Ward, Rev. T.*	*Jukes, W.*	*Parrott, E. B.*	..	..	..	..	..	..	..	..	2d. per wk.
Royton (Manchester).	Nat. Sch.	Whitaker, R.	Hill, Rev. R.	Taylor, W.	54	43	..	11	8	3	..	..	10d. per mo.
St. Austell (Cornwall)	*Nat. Sch.*	*Coode, A.*	*Ball, A. W.*	*Dyke, E. G.*	..	..	..	..	..	..	..	..	{ 3s. 6d. ea. subject.
St. Burian (Cornwall).	"	*Coulson, Rev. T. B.*	*Thomas, W.*	*Kissell, E.*	..	..	..	..	..	..	..	..	5s.
St. Helen's	Commercial Sch.	Mocatta, Rev. W. A.	Walthew, Rev. J. H.	Bournes, T.	23	20	..	3	4	..	..	..	2s. 6d.
St. Ives	*Nat. Sch.*	*Goldie, Rev. C. D.*	*Roffe, Rev. A. A.*	*Myhill, C.*	..	..	..	..	..	..	..	..	Nil.
St. Just	Institution	Boyns, R., 1st	Boyns, R., 2nd	{ Oats, F. George, T. }	14	8	..	6	..	..	..	..	{ 2s. 6d. each subject.

List of Science Schools, giving the Number of Students, &c.—*continued.*

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Salford	Wkg. Men's Coll.	Davies, T.	Plant, J.	Richardson, J.; Holl, J.; Law, E.; Monks, P.; Shorrocks, J. H.	53	80	27	..	11	15	..	1 B.	6d. & 1s. per. qr.
Salford	*Wes. Sch., Broughton Road*	*Lawn, W. S.*	*Bowman, H.*	*Thornton, J.*	..	..	..	..	..	..	..	..	1d. & 2d., some free.
Salisbury	*Sch. of Art*	*Hamilton, Very Rev. H. P.*	*Wilton, W. J.*	*Fraser, J. P.*	..	..	..	..	..	..	..	..	2s. per mo.
Saltaire (Bradford).	Lit. Inst.	Kelly, Rev. W.	Haley, F.	Severs, G.	..	34	34	..	..	2	..	..	2s. 6d.
Saltley (Birmingham)	Trg. Coll.	Smythe, Rev. P. M.	Smith, Rev. F.	Haworth, Rev. T. J.; Long, J.; Bulpitt, W. T.	20	66	46	..	37	16	..	..	Nil.
Scarborough	Mech. Inst.	Champley, R.	Delamere, N. H.	Beever, J.; Fox, C. B.; Potter, F.; Yewdall, J. H.	..	18	18	..	..	..	..	..	2s. 6d. each subject.
Seaham (Durham)	Infant Sch.	Cust, Rev. D. M.	Warham, W.	Rowden, W. T.; Jack, D.	..	33	33	..	..	6	..	..	3s. 6d.
Seaton Delaval (Durham)	Colliery Sch.	Forster, T. E.	Sanderson, T.	Rowden, W. T.; Kernick, R.; McDougal, T.	..	54	54	..	..	8	..	..	5s.
Shaw (Oldham)	Nat. Sch.	Crompton, J.	Bartleet, Rev. S. E.	Taylor, W.; Newton, I.	..	28	28	..	..	1	..	..	10d. per mo.
Sheerness	*Brit. Sch.*	*Bryant, Rev. G.*	*Blackman, I.*	*Brasier, C.*; *O'Donoghue, D.*	..	..	..	..	..	..	..	..	5s.
Sheffield	St. Paul's Sch.	Moore, T.	Darbyshire, Rev. B. S.	Sanderson, N.; Harrison, G.	..	23	23	..	..	..	..	..	21s., half returned if examd. Boys 1s. 6d.
"	Ch. Inst., St. James' Street	Sele, Rev. T.	Baker, W.	Sanderson, N.; Sutton, J.; Harrison, G.	..	35	35	..	..	5	..	..	
"	Ch. and Educ. Inst.	Foster, Rev. T.	Wardlow, C.	Allen, A. H.	..	15	15	..	..	..	..	..	6s. to 8s.
Sheffield	*Park Wes. Sch.*	*Hargreaves, Rev. J.*	*May, T.*	*Harrison, G.*	..	..	..	..	..	..	..	..	5s.
"	*Mech. Inst.*	*Moore, T.*	*Dawson, G.*	*Harrison, G. H.*	..	..	..	..	..	..	..	..	3s.

„	*Sch. of Art*	*Hobson, J.*	*Wightman, A.*	*Cox, W.*	..	..	..	..	..	..	..	..	15s. the season.
Shelton (Hanley).	*Nat. Sch.*	*Ashworth, T.*	*Strick, J.*	*Nevill, Rev. S. T.*	..	..	..	..	..	..	..	..	1d. per nt.
Shrewsbury	Sch. of Art	Humphreys, J. R.	Tasker, J.	Noyes, H. J.	..	4	4	..	..	1	..	..	5s. to 21s.
Skelmanthorpe (Huddersfield).	*Nat. Sch.*	*Newland, Rev. H.*	*Drummond, O.*	*Fawcett, J. L.*	..	..	..	..	..	..	..	..	2s.6d. ea. sub.
Slough	Mech. Inst.	Thompson, Rev. W. O.	Ward, W. H.	Dorrell, J. Dorrell, C. F. Dorrell, H. B. Davis, G. E.	22	53	31	..	4	12	..	..	Nil.
Southampton	Hartley Inst.	Chipperfield, R.	Le Feuvre, J. E.	Bond, F. T. Ranken, F. A.	49	146	97	..	1	4	..	..	5s. to 15s.
Southminster	Nat. Sch.	Page, W., jun.	Berkeley, Rev. G. C.	Fleming, J.	21	22	1	..	2	2	..	..	Nil.
Southport	Athenæum	Boothroyd, S.	Craven, R.	Spriggs, C.	..	14	14	..	..	1	..	..	2s. per qr.
South Shields *South Shields* „	Mech. Inst. *St. Hilda's* *Jarrow Chem. Wks.*	Stevenson, J. C., M.P.	Noble, J.	Legat, A. Denham, J. S. Armstrong, L. Crease, J. R. Rowden, W. T. Tyler, F. G. Ross, J. A. G. Grice, J. Hill, D. Meek, J. Kernick, R.	..	112	112	..	..	8	..	..	5s.
„	*Tyne Docks M. I.*	*James, W.*	*Powlson, S.*	*Walbank, J.*	..	..	..	..	..	..	..	..	1s. to 2s. 6d.
Stainland (Halifax)	Independent Sch.	Watts, Rev. L. L.	Haley, Rev. J.	Wilby, R.	..	9	9	..	..	1	..	..	2s.6d. to 3s. ea. subj.
„	Holywell Green M. I.	Shaw, S.	Shaw, S. W.	Shaw, J. Stopford, W. H. Nicholson, R. E.	..	12	12	..	..	3	..	..	2d. per wk.
Stalybridge	Mech. Inst.	Marsland, J.	Smith, D.	Hurst, W.	..	19	19	..	..	5	..	..	2s.
Staveley	*Works Sch.*	*Markham, C.*	*Selby, J.*	*Francis, E.*	..	..	..	..	..	..	..	..	2s.6d. to 5s. ea. subj.
„	*Schoolroom*	*Cottingham, J. E.*	*Macfarlane, Rev. J. D.*	*Craven, J.*	..	..	..	..	..	..	..	..	4s.
Stepney	Red Coat Sch.	Charrington, F.	Scott, W.	Parry, P. Bloomfield, J.	..	20	20	..	..	1	..	..	2s. 6d. ea. subject.
Stepney	*St. Paul's Sch.*	*Cotton, Rev. A. B.*	*Daveney, Rev. T. P.*	*Papworth, F.*	..	..	..	..	..	..	..	..	1s.
„	*Colet Boys' Sch.*	*Valentine, Rev. W.*	*Roe, Rev. J.*	*Jones, T.* *Browne, L.* *Phillips, E. R.*	..	..	..	..	..	..	..	..	Nil.
Stockport	Mech. Inst.	Walthew, J.	Stockdale, R.	Gee, W. Goodwin, J. W. Davies, G. W. Davenport, T.	45	54	9	..	19	8	..	..	2s. 6d. ea. subject.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
Stockport	Sunday Sch.	Wilkinson, S. W.	Hill, J.	Rathbone, T. H. Davies, G. W. Gosling, J. W.	18	34	16	..	5	1	..	..	2*s*. per qr.
Stoke-on-Trent	*Sch. of Art*	*Stamer, Rev. Sir L. P.*	*Keary, W.*	*Bacon, J. P.*	.	..	..	..	..	..	..	..	2*s*. ea. subj.
Stourbridge	Gram. Sch.	Freer, R. L.	Marten, E. B.	Welch, Rev. J. J. Packer, M. W. Kennedy, J.	..	16	16	..	..	..	..	..	4*s*. to 10*s*. 6*d*. pr. qr. ea. sub.
Stratford (Essex)	Wkg. Men's Hall	Scott, Rev. T.	Smith, E. E.	Farlie, J. L. Saunders, J.	58	58	..	..	37	19	..	..	6*s*.
Stratford (Essex)	*Brit. Sch.*	*Angell, L.*	*Taylor, C.*	*Swanson, W.* *Nankivell, G.*	..	..	..	..	..	..	..	..	5*s*.
Stratford-on-Avon.	*Nat. Sch.*	*Collis, Rev. J. D.*	*Gulliver, Rev. E. H.*	*Burrage, J. W. W.*	..	..	..	..	..	..	..	..	3*s*.
Stroud	Institute	Dickinson, S.	Gardner, H. F.	Smith, P. L.	29	89	60	..	11	4	..	..	1*s*. 6*d*. to 21*s*.
Stroud	*Sch. of Art*	*Winterbotham, R.*	*Dickinson, S. S.*	*Kemp, J.*	..	..	..	..	..	..	..	..	5*s*. per qr. ea. subj.
Sunderland	Monkwearmouth Colliery Sch.	Stobart, W.	Walker, J. E.	Rowden, W. T. Kernick, R. Jack, D.	..	41	41	..	..	..	..	..	5*s*.
Sunderland	*Sch. of Art*	*Burnet, Rev. W. R.*	*Hills, W. H.*	*Thomas, S.*	..	..	..	..	..	..	..	..	1*s*. 6*d*. per month.
,,	*Wkg. Men's College*	*Thompson, W.*	*Wood, P.*	*McLaren, J.* *Lambton, J. W.*	..	..	..	..	..	..	..	..	5*s*.
Sunninghill (Staines).	*Wes. Day Sch.*	*Portrey, Rev. J.*	*Walker, R.*	*Stokes, J.*	..	..	..	..	..	..	..	..	Nil.
Sutton (Surrey)	*Nat. Sch.*	*Neame, A.*	*Hind, W. L.*	*Knibbs, H.*	..	..	..	..	..	..	..	..	1*d*. and 2*d*. per night.
Sutton Coldfield	*Town Hall*	*Bedford, Rev. W. K. R.*	*Bodington, G. F.*	*Jennings, J. M.*	..	..	..	..	..	..	..	..	1*s*. to 2*s*. 6*d*.
Swansea ,,	Royal Inst. Oxford St. Nat. Sch.	Jenkins, J. J.	Williams J.	Smith, A. Bell, W. G. Cole, F. Hocking, H. Hosford, F. F. Mollison, A.	45	92	47	..	4	10	..	..	5*s*. to 7*s*. per subj.

Swinton (Manchester).	*Mech. Inst.*	*Heywood, Rev. H. R.*	*Kenyon, N.*	*Stott, H.*	..	..	..	..	..	..	..	..	2s. 6d.
Tavistock	Brit. Sch.	Newland, Rev. J. M.	Luxton, R.	Moffatt, W. Rowe, W. Moffatt, J.	50	81	31	..	22	5	..	1 S.	2s. 6d. ea. subject.
"	Nat. Sch., Dolvin Rd.	Tancock, Rev. O. J.	Monk, H. E.	Merrifield, J. Rider, A. J. Balkwill, F. P.	..	63	63	..	..	4	..	..	2s. 6d. ea. subject.
"	Sch. of Art	Tancock, Rev. O. J.	Greenfield, T. W.	Robjohns, F. R.	..	15	15	..	..	2	..	..	2s. 6d. ea. subject.
"	Duke of Bedford's Sch., Gulworthy	Alford, Rev. D. P.	Philips, W.	Gaud, J. H. Gaud, J. W.	34	68	34	..	9	3	1 B.	..	2s. 6d. ea. subject.
"	St. Mary Tavy N. S.	Gibbons, Rev. T.	Buller, Rev. A.	Rowe, W.	..	14	14	..	..	..	..	..	1s. ea. class.
Tebworth (Bedfordsh)	Wes. Day Sch.	Seccombe, Rev. W.	Gurney, N.	Mackrell, I.	13	11	..	2	3	..	..	..	1s. 6d. ea. subject.
Thorne (Doncaster).	Brookes' Gram. Sch.	Kenyon, G.	Lister, W.	Constable, J.	17	23	6	..	5	..	..	..	2s. 6d. pr. qr.
Thornton (Bradford).	*Mech. Inst.*	*Craven, J.*	*Wright, T. H.*	*Sugden, W.*	..	..	..	..	..	..	..	..	1s. per qr.
Thrapstone	*Nat. Sch.*	*Bagshaw, Rev. W. S.*	*Goodman, Rev. J. P.*	*Graves, J. J.*	..	..	..	..	..	..	..	..	Nil.
"	*Brit. Sch.*	*Wilkinson, J. R.*	*Ibbs, C. W.*	*Roe, R. G.*	..	..	..	..	..	..	..	..	1s. 6d.
Toddington (Dunstable).	Nat. Sch.	Cooper, W. C.	Clegg, Rev. J.	Billingham, E.	..	2	2	..	..	..	..	..	2s. 6d.
Toddington	*Wes. Sch.*	*Akehurst, Rev. S. H.*	*Burchell, Rev. W.*	*Roberts, T.*	..	..	..	..	..	..	..	..	1d. per wk.
Todmorden	*Mech Inst.*	*Fielden, J., M.P.*	*Whitehead, J.*	*Kershaw, T.*	..	..	..	..	..	..	..	..	5s. per crse.
Topsham and Woodbury.	*Mut. Imp. Soc. and End. Sch.*	*Davy, D. B.*	*Roberts, W.*	*Sparkes, A. L.*	..	..	..	..	..	..	..	..	6d.
Torquay	Sci. and Art Sch.	Evanson, R. J.	Luxmoore, C. N.	Viccars, T.	63	90	27	..	28	23	1 B.	..	2s. 6d. to 21s. per subj.
Towcester	Nat. Sch.	Hesketh, Sir T. G. F., Bart., M.P.	Lightfoot, Rev. R. P.	Jones, J. C.	..	50	50	..	..	2	..	..	1d. per wk.
Truro	Brit. Sch.	Tweedy, R.	Clyma, G.	Snell, J.	..	17	17	..	..	..	..	..	2s. 6d. ea. subject.
"	Royal Inst.	Barham, C.	Mayne, J. O.	Collins, J. H.	..	24	24	..	..	..	..	..	5s.
Turton (Bolton)	Chapel Town Inst.	Spencer, Rev. J. O. K.	Isherwood, W.	Stott, H., sen.	..	26	26	..	..	4	..	..	1s. 6d.
Tyldesley (Manchester)	Mech. Inst.	Green, G.	Lomax, W.	Stott, H., jun. Haslam, W.	..	30	30	..	..	8	..	..	Nil.
Ulverstone	Proprietary Sch.	Fell, J.	Sykes, J. S.	Eckersley, H.	18	9	..	9	2	..	..	..	5s. ea. subj.
Wakefield	Industrial and Fine Arts Inst.	Lee, W. H.	Dixon, J. H.	Smith, W. Sturgeon, W.									5s.
"	Mech. Inst.	Whitham, S.	"	Patchett, I. Jefferson, S. Knowles, M.	..	18	18	..	..	4	..	..	1s. to 5s.
"	Smyth St. Academy												
"	Trinity Ch. Sch.												
Walker	*Alkali Works Sch.*	*Thompson, Rev. C.*	*Steele, Rev. J.*	*Bewick, T.*	..	..	..	..	..	..	..	..	2s. 6d. per quarter.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
Wallingford	*Sch.-room, Thames Street.*	*Hawkins, H.*	*Steer, C.*	*Gubb, E.*	..	..	..	..	..	..	..	..	Nil.
Walsall	*Wesley Day Schs.*	*Cox, S.*	*Brocksop, W. H.*	*Smith, D.* *Smith, A. F.*	..	..	..	..	..	..	..	..	1*s.* ea. subj.
Watford	*Lit. Inst.*	*Brett, A. T.*	*Wallis, W.*	*Fairman, J. B.*	..	..	..	..	..	..	..	..	9*d.* per mo.
Wednesbury	*St. John's Schs.*	*Bill, T.*	*Stoney, Rev. R. B.*	*Williams, J.*	..	..	..	..	..	..	..	..	1*d.* per nt. or 1*s.* 6*d.* per crse.
"	*Moxley Nat. Sch.*	*Wilson, Rev. J. P.*	*Pocock, R. R.*	*Williams, J.*	..	..	..	..	..	..	..	..	1*d.* pr. night.
Weedon	Girls' Sch.	Winter, Rev. J. S.	Williamson, A.	Norman, S. A.	..	42	42	..	..	..	..	..	2*s.*
Wellingborough	Lower Gram. Sch.	Sherwood, R. W.	Roxby, Rev. H. M.	Winterton, W. Genner, B. Percival, W. Sanders, W. F.	30	52	22	..	12	4	..	..	2*s.* 6*d.*
West Bromwich.	St. Peter's Sch.	Jordan, T.	Massey, Rev. C.	Hill, S. T.	..	20	20	..	..	..	..	..	2*s.* 6*d.*
Westbury-on-Trym.	Girls' Sch.	Bright, Rev. J. H.	Pease, T.	Gandee, A. G.	..	36	36	..	..	9	..	..	2*s.* per mo.
West Gorton (Manchester).	St. Mark's N. S.	Connell, Rev. A.	Jackson, T.	Ward, R. P.	..	25	25	..	..	..	..	..	1*d.* per nt.
Whaleybridge	Spring Bank Chapel	Kirk, J.	Colles, A. H.	Jackson, R.	19	12	..	7	2	1	..	..	3*s.*
Whitehaven	*Scient. Assoc.*	*Dalton, Rev. M. S.*	*Taylor, B.*	*Tosh, E. G.* *Kitchen, A.* *Moon, M. A.* *Pickering, R.*	..	..	..	..	..	..	..	..	1*s.* to 2*s.* 6*d.* each sub.
Whitworth (Rochdale).	Lit. Inst.	Kay, E. G.	Wolfenden, J.	Sutcliffe, G. W.	..	24	24	..	..	3	..	..	5*s.*
Wickham Market (Suffolk).	*Nat. Sch.*	*Image, Rev. W. T.*	*Read, C. H.*	*Bales, W. J.*	..	..	..	..	..	..	..	..	8*s.*
Wigan	Mech. Inst.	Fergie, Rev. T. F.	Peace, M. W.	Betley, R. Percy, C. M. Hay, R.	71	91	20	..	17	6	1 B.	..	4*s.* to 2*l.* 16*s.* per subject.
Wilmslow (Cheshire).	*Fulshaw Day Sch.*	*Somerville, T.*	*Jessop, W.*	*Dale, J.*	..	..	..	..	..	..	..	..	2*s.* per qr.
Wilden (Bingley).	Mech. Inst.	Clapham, P.	Watmuff, W. G.	Severs, G.	..	11	11	..	..	1	..	..	2*s.* 6*d.*
Winchester	*Brit. Sch.*	*Underwood, R.*	*Reynolds, S. P.*	*Barter, W. A.*	..	..	..	..	..	..	..	..	5*s.* ea. sub.

Windsor	Mech. Inst.	Chamberlain, T.	Lundy, J.	Dorrell, H. B.	..	30	30	..	..	5	..	..	1s. per qr.
Wisbech	Wkg. Men's Inst.	Scott, Rev. J.	Balding, A.	Miller, S. H.	24	40	16	..	7	..	..	..	1s. per qr.
Woburn	*Boy's Sch.*	*Cumberlege, Rev. S. F.*	*Shepherd, Rev. R.*	*Assbee, J.*	..	..	..	..	..	..	..	..	Nil.
Woking (Surrey)	St. John's Sch.	Wilks, Rev. T. C.	McCormack, R.	Goffin, R. Goffin, Mrs. J.	..	53	53	..	..	..	..	..	4s.
Woking Station	*Com. Sch., Knaphill*	*Brushfield, T. W. G.*	*Radford, J. C.*	*Rushforth, T.*	..	..	..	..	..	..	..	..	2s.6d.pr.qr.
Wolverhampton *Wolverhampton*	St. Peter's Inst. *G. W. Ry. Inst.*	Iles, Rev. J. H.	Langley, J. N.	Horton, F. C. Berry, E. Stanier, W. H. Golby, T.	38	64	26	..	13	3	..	1 S.	1s. 6d. to 5s.
"	St. John's Sch.	Hampton, Rev. H.	Hilliard, Rev. A. B.	Board, G.	4	18	14	..	..	..	..	..	8s. per sess.
Wolverton (Bucks.)	Sci. and Art Inst.	Mumford, A. C.	Meadley, J.	Harnett, Rev. F. W. Nichols, T. Davison, W. Moore, T.	65	82	17	..	18	7	..	..	4s. 6d. per quarter.
Woodville (Burton-on-Trent)	Nat. Sch.	Wilmshurst, Rev. A. T.	Betterton, H. I.	Binns, A.	..	13	13	..	..	2	..	..	4s. per qr.
Woolwich	Roy. Arsl. Sci. Classes	Oram, W. E. S.	Keeble, W. D.	Jones, T. Noble, J. Clarke, J. J. Crowe, J. Jones, E. S. L. Duckett, W. Brittle, J. R. Brown, L. Purnell, J. W.	144	171	27	..	55	42	1 B.	1 B.	2s. 6d. to 10s. per subject.
"	Nat. Sch.	Brown, Rev. H.	Harrison, Rev. F. S.	Farlie, C. J. Wilson, J.	40	55	15	..	33	2	..	..	5s.
"	Presbyterian Schs.	Thompson, Rev. W. M.	Ronald, H.	Jones, T. Browne, L. Courtman, R. J. Downar, W. A. McDougall, H. S. Browne, Mrs.	98	125	27	..	8	1	..	..	Nil.
"	St. Michael's Sch.	Baker, Rev. H. R.	Walter, J. W.	Byatt, H.	15	34	19	..	13	1	..	..	5s.
Worcester	Young Men's Christ. Assoc.	Barnett, R. E.	Day, H.	Ewens, F. T. Pember, J. Cradock, E. W.	71	104	33	..	19	16	..	..	2s.6d.ea.sub.
Worcester	*Trade School*	*Blair, Rev. R. H.*	*Eaton, F.*	*Spencer, J.* *Evans, R.*	..	..	..	..	..	..	..	..	5s. 6d. to 10s. 6d.
"	" *(Evg. Classes)*	"	"	*Spencer, J.*	..	..	..	..	..	..	..	..	4s. ea. sub.
"	*St. John's Sch.*	*Wood, Rev. J. R.*	*James, Rev. J. C.*	*Walker, S.*	..	..	..	..	..	..	..	..	2s.6d.ea.sub.

List of Science Schools, giving the Number of Students, &c.—*continued.*

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Yarmouth, Gt.	Sch. of Navigation and Gram. Sch.	Wolverton, C.	Bracey, J.	Stockton, W.	81	98	17	..	1	1	..	..	6*d.* to 5*s.* per week per subj.
Yarmouth, Gt.	*Sch. of Art*	*Wolverton, C.*	*Cubitt, F. A.*	*Dominy, J. S.*	..	..	..	..	..	..	..	..	2*s.* per mo. each sub.
York	Institute	Palmer, Rev. H. V.	Williams, J.	Proctor, W.; Greenwell, Rev. W.; Robinson, E.; Senior, W. C.	80	51	..	29	6	2	..	..	Nil.
"	Bluecoat Sch.	Richardson, W.	Ford, J.	Robinson, E	..	20	20	..	..	1	..	..	Nil.
"	Training Sch.	Hey, Rev. W.	Bresher, Rev. M. R.	Rowe, Rev. G.	..	16	16	..	..	..	..	..	Nil.
York	*Brit. Sch., Hope St.*	*Rowntree, J.*	*Sessions, W.*	*Pumphrey, W.*; *Thompson, R.*	..	..	..	..	..	..	..	..	Nil.
"	*Sch. of Art*	*Hey, Rev. W.*	*Procter, W.*	*Swallow, J. C.*; *Stephenson, J. F.*	..	..	..	..	..	..	..	..	5*s.* 3*d.* to 31*s.* 6*d.*
				SCOTLAND.									
Aberdeen	Mech. Inst.	Urquhart, R.	Sinclair, J.	Beveridge, R.; Maver, D.	61	280	219	..	3	2	..	..	6*s.* to 10*s.* per subj.
Alexandria (Ayrsh.)	Mech. Inst.	Ewing, J. O.	Greenlees, W.	Tatlock, R. R.; Millar, W. J.; Andrew, D.	..	99	99	..	..	..	..	..	4*s.* to 9*s.*
Baillieston (Glasgow).	*Crosshill Sch.*	*Ramsay, Rev. H.*	*Dickson, J.*	*Jarvie, P.*	..	..	..	..	..	..	..	..	3*s.*
Banton (Denny).	Public Sch.	McPherson, J.	Walker, J.	Forbes, M. C.	..	17	17	..	..	4	..	..	5*s.*
Beith	New St. Sch.	Muir, W.	Kerr, J.	Cook, W.	7	24	17	..	..	..	..	..	3*s.* 6*d.* per quarter.
Brechin	Free Ch. Sch.-room	Scott, D.	Craig, J.	Cameron, J.	..	31	31	..	..	..	..	..	1*s.* 4*d.* per month.

Corsock (Dalbeattie)	Girls' Sch.	Sturrock, Rev. G.	Currie, R.	Macomish, M.	13	12	..	1	4	..	..	..	1s. each subject.
Cults (Aberdeensh.)	Schoolroom	Paul, Rev. W.	Taylor, J.	Summerfield, H.	..	13	13	..	..	2	..	..	2s. 6d.
Dingwall	*Academy*	*Davidson, D.*	*Joass, W. C.*	*Boyd, J.*	..	..	..	..	..	..	..	..	5s.
Dumbarton	Burgh Academy	Paul, M.	Babtie, J.	Dickie, H.; Anderson, W.; Cormack, A.	12	114	102	..	..	6	..	..	10s. each subject.
Dundee	High Sch.	Thoms, W.	Cumming, A. W.	Kennedy, J.	70	90	20	..	6	5	1 G., 1 B.	..	6s. per 3 months.
Edinburgh	Free Ch. Trg. Coll.	Law, W.	Archer, T. C.	MacAdam, S.; Lees, W.; Pryde, J.; Kennedy, W.; *Davidson, Dr.*	..	49	49	..	..	13	..	..	Nil.
,,	Watt Inst. and Sch. of Arts				..	377	377	..	..		..	..	
Edinburgh	*15, Buccleuch Pl.*				..	..	..	..	..	..	..	..	5s. ea. sub.
,,	*Est. Ch. Trg. Coll.*	*Cook, Rev. J.*	*Laurie, S. T.*	*Mackinlay, P.*; *Currie, Rev. J.*	..	..	..	..	..	..	..	..	Nil.
Elgin	*New Mill Manuf. and Iron Works*	*Russell, A.*	*Duff, T. D.*	*Pattison, R.*; *Russell, T.*	..	..	..	..	..	..	..	..	5s. each subject.
Fortrose (Inverness).	*Mech. Inst.*	*Mackenzie, A. R.*	*Smith, J.*	*Young, Rev. R. C.*	..	..	..	..	..	..	..	..	2s. 6d.
Glasgow	Sec. Sch.	McClelland, J.	Cunliff, R. S.	Mayer, J.; Lochore, J.; Stone, W.; Mayer, Mrs.	80	113	33	..	22	6	..	..	2s. 6d. to 6s. per qr.
,,	Anderson's Univy.	Young, J.	Martin, G.	Herschel, A.; Buchanan, G.; Macadam, S.; Laing, A.; Hennedy, R.	730	1,013	283	..	33	10	1 B.	..	2s. 6d. per quarter to 21s. per session.
,,	Mech. Inst.	Neilson, W. M.	Anderson, J.	Thom, A. H.; Moffatt, R. C.	950	500	..	450	7	..	1 S.	..	4s. per 6 months to 6s. 6d. per qr.
,,	Est. Ch. Trg. Coll.	Craik, Rev. J.	Snodgrass, G. W.	Dixon, E. M.	..	74	74	..	..	9	..	..	Nil.
Glasgow	*St. George's Sch.*	*Craik, Rev. J.*	*Snodgrass, G. W.*	*Mayer, J.*	..	..	..	..	..	..	..	..	1s.
,,	*St. Stephen's Par. Sch.*	*Miller, Rev. T.*	*Watson, T. H.*	*Macaulay, J.*	..	..	..	..	..	..	..	..	1s. to 2s. 6d. per qr.
,,	*Port Dundas Sch.*	*Macleod, Rev. D.*	*Ker, W.*	*Mayer, J.*	..	..	..	..	..	..	..	..	1s.
Inverness	Sci. and Art Sch.	Simpson, A.	Galloway, G.	Pratt, R.	27	18	..	9	3	..	..	..	4s. to 6s. per qr.
Inverness	*Royal Academy*	*Thrum, H.*	*Hay, A. P.*	*Duncan, W. S.*; *Eadie, W.*	..	..	..	..	..	..	..	..	6s. to 10s. 6d.
Johnstone	*Quarrelton Par. Sch.*	*Donald, J.*	*Malloch, W., jun.*	*Mayer, J.*	..	..	..	..	..	..	..	..	1s. 6d.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction. 1868.	1869.	Increase.	Decrease.	Number of Prizes. 1868.	1869.	Number of Medals. 1868.	1869.	Fees paid by Students.
Kilmarnock	East George Street	Dickie, J.	MacKay, J.	Stevenson, J. Hastie, W. McCulloch, W. Neil, J. Johnston, R. Dunlop, P. Gunnyon, Wm. Grant, T. Black, P. M.	76	127	51	..	14	..	..	..	2s. 6d. to 5s. ea. sub.
"	Princes Street				..	50	50	..	..	8	..	..	5s. ea. subj.
Kilmarnock	*Sch. of Art*				..	..	..	..	..	..	..	..	Included in Art.
Kirkcaldy	*People's Inst.*	*Swan, P. D.*	*Findlater, J.*	*Aikman, G.*	..	..	..	..	..	..	..	..	3s. to 6s.
Kirkwall	Gram. Sch.	Robertson, J.	Heddle, P. S.	Watson, J.	10	53	43	..	..	..	..	..	2s. 6d. ea. subject.
Leith	Navigation Sch.	Watt, J.	Thomson, Rev. J.	Bolam, J.	228	289	61	..	..	1	..	..	1s. 3d. per week, 5s. per course per each subject.
Leith	*St. James' Sch.*	*Blanshard, G.*	*Falconar, Rev. J. S.*	*Jackson, Rev. G.* *Hodson, S.*	..	..	..	..	..	..	..	..	Nil.
"	*Sch. of Art*	*Watt, J.*	*Thomson, Rev. J.*	*Bain, R. L.*	..	..	..	..	..	..	..	..	2s. per mo.
Lumphanan (Aberdeen).	*Par. Sch.*	*McCombie, Rev. C.*	*Milne, J.*	*Cramond, W.*	..	..	..	..	..	..	..	..	2s. 6d.
Nairn	*Genl. Assemy. Sch.*	*Burns, Rev. J.*	*Wilson, J. H.*	*Dick, J.*	..	..	..	..	..	..	..	..	1s. to 1s. 6d. per mo.
Newhills (Aberdeen).	Stoneywood Sch.	Smith, Rev. J.	Black, G.	Williamson, W. A.	17	30	13	..	..	2	..	..	3s.
Paisley	*George St. Sch.*	*Cowan, H.*	*Martin, F.*	*Mayer, J.*	..	..	..	..	..	..	..	..	1s.
"	*Sch. of Art*	*Murray, D.*	*Hodge, W.*	*Stewart, W.*	..	..	..	..	..	..	..	..	5s. per qr.
Perth	Sch. of Art	Barclay, H.	McNeill, J.	Stevenson, R. J.	..	15	15	..	..	8	..	..	6s. per qr.
Rothesay	*Thomson Inst.*	*Macbeth, D.*	*McEwen, J.*	*Fraser, D. D.*	..	..	..	..	..	..	..	..	3s. 6d.
St. Andrew's	*Madras Coll.*	*Milton, W. T.*	*Lees, G.*	*Brodie, J.* *Patterson, A.*	..	..	..	..	..	..	..	..	4s. to 6s. per subj.
Stirling	Sch. of Art	Murrie, J.	Shearer, R. S.	Baker, L.	..	18	18	..	..	2	..	..	2s. 6d. per mo. to 6s. per qr.
Tarbat	Parochial Sch.	Campbell, Rev. G.	Mackie, J.	Fraser, Rev. D.	16	41	25	..	1	..	..	..	4s.

IRELAND.

Aghnagar -	*Nat. Sch.* -	*Crossle, J.* -	*Clements, M.* -	*Bothwell, T. H.* -	..	..	..	..	..	..	..	..	Nil.
Ahoghill (Ballymena)	" -	*Rowan, Rev. R. W.*	*Millar, W.* -	*McIlroy, H.* - *McIlroy, R.* -	..	..	..	..	..	..	..	..	2s. 6d.
Anahilt (co. Down).	School-room -	Erwin, Rev. R. S. -	Moorhead, Rev. R.	Clements, A. -	..	19	19	..	..	..	..	..	Nil.
Antrim - " - *Antrim* -	Main St. N. S. Malo N. S. - *Ladyhill N. S.*	Massareene, The Viscount -	Taggart, W. J. -	Bonar, J. - Foley, M. R. - Savage, H. - Stewart, J. -	66	78	12	..	14	3	..	..	2s. 6d. to 4s. per subject.
Ardara (co. Donegal) -	*Female N. S.* -	*Evans, J. M. B.* -	*Brenan, J.* -	*O'Roddy, J.* - *Ward, J. C.* -	..	..	..	..	..	..	..	..	2s. 6d.
Armagh -	College Street and Gosford Pl. Schs.	McAlister, Rev. J. R.	Osborne, A. T. -	Lee, H. - McKimm, S. -	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Athlacca (Kilmallock)	*Nat. Sch.* -	*Synan, E. J., M.P.* -	*Quaid, Rev. D.* -	*Quinn, J.* -	..	..	..	..	..	..	..	..	Not yet arranged.
Athlone -	Parochial Sch. -	Handcock, Hon. R. J.	Joly, Rev. J. S.	James, M. H. -	87	50	13	..	16	3	2 B.	..	Nil.
" -	Ranelagh Sch. -	Pidgeon, W. -	Foster, Rev. R. -	Macintosh, W. T. Quinton, R. F. -	33	36	4	..	35	1	..	..	Nil.
Athlone -	*Anchors Bower Sch.*	*Maxwell, P.* -	*Gleeson, E. M.* -	*Finnegan, H.* -	..	..	..	..	..	..	..	..	Nil.
Athy -	*Town Hall* -	*Kynsey, T. B.* -	*Cross, W. C.* -	*Henderson, J. J.* -	..	..	..	..	..	..	..	..	Total, 80s.
Aughnacloy (co. Tyrone)	*Court House* -	*Scott, W.* -	*McKay, W. C.* -	*Wilson, D.* -	..	..	..	..	..	..	..	..	To be computed.
Bagenalstown (co. Carlow)	Nat. Sch. -	Hagarty, E. -	Morrin, Rev. P.	Fitzgerald, E. - Cox, J. S. -	39	52	13	..	7	2	..	..	2s. 6d. ea. subject.
Bailieboro' (co. Cavan)	Mod. Sch. -	Dalton, G. T. -	Simpson, A. J. -	Doherty, J. J. -	84	125	41	..	38	20	1 G. 1 S.	..	2s. 6d.
Ballee (co. Antrim).	*Nat. Sch.* -	*Patrick, J. B.* -	*Wasson, S.* -	*Hatton, S.* -	..	..	..	..	..	..	..	..	Nil.
Ballincollig (co. Cork).	" -	*Rowntree, G.* -	*Riorden, D. J.* -	*Reynolds, E.* -	..	..	..	..	..	..	..	..	Nil.
Ballybay (co. Monaghan)	Nat. Sch. -	Ffennell, Rev. R., A.B. -	McMurray, T. -	Beatty, R. -	..	16	16	..	..	1	..	..	2s. 6d.
Balleybofey (co. Donegal).	*Town Hall* -	*Johnston, J. S.* -	*Millar, A.* -	*Patterson, W.* -	..	..	..	..	..	..	..	..	2s. 6d.
Ballymena -	Mod. Sch. -	Rowan, Rev. R. W. -	Wilson, D. M. -	Shannon, A. F. -	18	28	10	..	4	2	..	..	Nil.
" -	Guy's Nat. Sch. -	Patrick, J. -	Killen, J. -	Alexander, J. -	..	28	23	..	..	1	..	..	2s. 6d.
" -	Crebilly N. S. -	Kidd, A. -	Lynch, Rev. J. -	McCormick, J. -	..	5	5	..	..	..	..	..	2s. 6d.
Ballymena -	*Nat. Sch.* -	*Kidd, A.* -	*Lynch, Rev. J.* -	*Black, R.* -	..	..	..	..	..	..	..	..	2s. 6d.
" -	*Harryville N. S.* -	"	"	*O'Neill, A.* -	..	..	..	..	..	..	..	..	2s. 6d.
Ballymoney (co. Antrim).	Town Hall -	McElderry, T. -	McElroy, S. C. -	Elliott, T. -	..	30	30	..	..	3	..	..	Nil.
Ballynahinch (co. Down).	" -	Anketell, W. R. -	Bruce, W. J. -	Priestley, J. R. -	..	29	29	..	..	..	..	..	Nil.
" -	Alfred St. N. S. -	" -	" -	Goodman, J. -	..	12	12	..	..	..	..	..	2s. 6d.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
Ballyvicknakelly (co. Down)	*Nat. Sch.*	*M'Kee, Rev. J.*	*Strain, Rev. J. K.*	*Mackintosh, J.*	..	..	..	..	..	..	..	..	2s. ea. subj.
Ballywalter (co. Down)	Park Sch.	Wilson, Rev. H.	Magill, Rev. D.	McConkey, J. Purse, W.	..	56	56	..	..	..	..	..	2s. 6d. ea. subject.
Ballywilly (co. Armagh)	Nat. Sch.	Irwin, Rev. J.	Keegan, T.	Lee, H. Lee, S.	19	23	4	..	..	..	..	..	2s. 6d.
Balyna	*Nat. Sch.*	*O'Ferrall, A. M.*	*Bourke, C.*	*Traynor, J.*	..	..	..	..	..	..	..	..	Nil.
Bandon	*Allin Inst.*	*Wheeler, J.*	*Eccles, Rev. R. G.*	*Bateman, T.*	..	..	..	..	..	..	..	..	Nil.
Bangor (co. Down).	Endowed Sch.	Binney, Rev. R.	Patteson, Rev. W.	Harvey, I.	..	25	25	..	..	..	..	..	Nil.
Barnesmore (co. Donegal).	*Nat. Sch.*	*Pope, R. H.*	*Dunlevy, J.*	*Ward, C. H.*	..	..	..	..	..	..	..	..	2s. 6d.
Belfast	Union Place N. S.	Taylor, D.	Shepherd, W.	Anderson, J.	..	25	25	..	..	..	..	..	5s.
"	May Street	"	"	Cullen, W.	..	..	..	..	..	..	..	..	2s. 6d.
"	Fisherwick Pl. N. S.	"	"	Cleeland, R. Elliott, T.	83	76	..	7	18	6	1 B.	..	5s. ea. subj.
"	Conway St. N. S.	"	"	Kerrigan, J.	..	23	23	..	..	..	..	..	Nil.
Belfast	*New Road St. N. S.*	*Taylor, D.*	*Shepherd, W.*	*Burrowes, Miss C. W.*	..	..	..	..	..	..	..	..	Nil.
"	*Wellington Acad.*	"	"	*Perry, J.* *Whitford, W.*	..	..	..	..	..	..	..	..	7s. 6d.
"	*Victoria Place Sch.*	"	"	*Boal, J.*	..	..	..	..	..	..	..	..	2s. 6d.
"	*Nat. Sch., Townshend St.*	"	"	*Erskine, W.*	..	..	..	..	..	..	..	..	5s.
"	*Northumberland St. Nat. Sch.*	"	"	*Small, H.*	..	..	..	..	..	..	..	..	Nil.
"	*Albion St. N. S.*	"	"	*Dunlop, S.*	..	..	..	..	..	..	..	..	2s. 6d.
"	*Tennent St.*	"	"	*Trodden, P.*	..	..	..	..	..	..	..	..	Nil.
"	*Queen's Bridge N. S.*	"	"	*Brown, R.*	..	..	..	..	..	..	..	..	Nil.
"	*Nat. Sch., Academy St.*	"	*Hanna, Rev. H.*	*Burrowes, Miss C. W.*	..	..	..	..	..	..	..	..	Nil.
Belfast	Model Sch.	Jones, Rev. R. G.	Molloy, J.	Doran, G. Wren, H. Smeeth, R.	141	122	..	19	40	8	..	..	20s. to 50s.

,,	Academy St. N. S.	McCausland, S.	Hanna, Rev. H.	Barbour, S. Campbell, D.	13	29	16	..	7	6	..	..	Nil.
,,	People's Lit. Inst.	Cottar, Rev. W.	Maitland, F. A.	Perry, J. Whitford, W. Small, H.	..	117	117	..	..	3	..	..	9s. per subj.
,,	Brown St. Sch.	Lytle, J.	Johnston, Rev. W.	Donaldson, T. Keatley, W. J.	..	80	80	..	..	2	..	..	Nil.
,,	Nelson St. N. S.	Knox, Rev. R.	Hannah, S.	Bingham, H.	..	14	14	..	..	5	..	..	Nil.
Belfast	*Frederick St. N. S.*	*Guard, Rev. W.*	*Jones, Rev. J. W.*	*Bingham, H.*	..	..	..	..	..	..	..	..	10s. ea. if they do not come up for exam.
,,	*Linfield Road N. S.*	*McCausland, S.*	*Hanna, Rev. H.*	*Thompson, J.*	..	..	..	..	..	..	..	..	Nil.
,,	*Mercantile Acad.*	*Browne, T. H.*	*Greenlees, Rev. J.*	*Pyper, J.*	..	..	..	..	..	..	..	..	5s.
,,	*Clarence Place Hall*	*Johnston, W. J.*	*Allworthy, E.*	*Cleeland, R.* *Wilson, P.*	..	..	..	..	..	..	..	..	5s. ea. subj.
,,	*Canning St. Acad.*	*Coates, J.*	*Pyper, J.*	*Leslie, A.*	..	..	..	..	..	..	..	..	Nil.
Beragh (co. *Tyrone*)	*Loan Fund Office*	*Ellis, F.*	*Dixon, Rev. R. V.*	*Martin, W. H.*	..	..	..	..	..	..	..	..	5s.
Bessbrook (Newry).	School-house	Lett, H. W.	Wonfor, W. J.	Sands, T.	21	12	..	9	2	..	..	..	2s. 6d.
Bonecastle (Downpatrick).	*Nat. Sch.*	*Bell, J. H.*	*Bell, J.*	*Nesbitt, J.*	..	..	..	..	..	..	..	..	Nil.
Bornafea (co. *Kilkenny*).	,,	*Kinsella, Rev. B.*	*Lyons, Rev. N.*	*Walshe, J.*	..	..	..	..	..	..	..	..	3s. 6d.
Bruckless (co. *Donegal*).	,,	*Cassidy, S.*	*Kelly, Rev. P.*	*O'Roddy, J.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Bushmills (Coleraine)	,,	*Boyle, Rev. J.*	*Kirkpatrick, Rev. J. G.*	*Elliott, D.*	..	..	..	..	..	..	..	..	2s. 6d.
Caledon (Armagh)	Infant Sch.	Alexander, R.	Armstrong, Rev. W. B.	Wilkin, R. D. Wilson, C. E.	..	17	17	..	..	..	..	..	2s. 6d.
Callan	*Academy*	*O'Keeffe, Rev. R.*	*Sweeny, M.*	*Howe, W.*	..	..	..	..	..	..	..	..	Nil.
Carlow	Chrn. Sch.	Tyman, M. F.	McGrath, D.	Mayne, A. J.	21	29	8	..	1	4	..	..	2s. 6d. per annum.
Carrickfergus	Mod. Sch.	Birnie, T. M.	Pasley, D.	Stevenson, J. M.	42	59	17	..	16	8	..	..	5s.
Castleblaney	*Annayallo N. S.*	*Wolfe, Ven. J. C.*	*Flanagan, P.*	*Beatty, R. C.* *McAdam, J.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Castlederg (co. Tyrone)	The Edward's Sch.	Edwards, Rev. E.	Crockett, Rev. J.	McGreuahan, W. Colhoun, C.	..	25	25	..	..	..	..	..	Nil.
Castlewellan (co. *Down*).	*Annsboro' N. S.*	*Shaw, W.*	*Murland, C.*	*Bell, J.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Cloncore (co. Armagh)	Nat. Sch.	Robinson, Rev. G.	Clements, Rev. W.	Carson, R. McNamee, T.	..	8	8	..	..	6	..	..	2s. 6d. ea. subject.
,,	Eglish Nat. Sch.	McVarry, Rev. T.	McNulty, Rev. P.	,,	51	20	..	31	5	..	..	..	2s. 6d. ea. subject.
Clonmel	*Model Sch.*	*Woods, E.*	*O'Hara, T.*	*Stevenson, T.*	..	..	..	..	..	..	..	..	30s. to 32s. 6d. per subj.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
Clonmel - -	*Sch. of Art* - -	*Hackett, J.* - -	*Purcell, P. J.* -	*Fraser, E. A.* - -	..	..	..	..	..	..	..	..	2s. 6d. to 5s.
Coalisland (co. *Tyrone*).	*Infant Sch.* - -	*Young, Rev. W. J. M.*	*Foster, Rev. J.* -	*Campbell, W.* - -	..	..	..	..	..	..	..	..	Nil.
Coleraine -	Mod. Nat. Sch. -	Bruce, Sir H. H., M.P.	Bole, W. - -	Bresland, J. - -; Cassidy, H. - -	60	28	..	32	14	5	..	..	2s.6d. to 5s. per subj.
Comber - -	Smyth's Nat. Sch. -	Rogers, Rev. J.	Rogers, T. -	Minniss, J. - -	96	92	..	4	15	1	..	..	5s.
,, - -	Lisbarnet Nat. Sch.	Anderson, Rev. D. -	Smiley, W. -	Cleland, J. M. -									2s. 6d.
Connor (co. *Antrim*).	*Nat. Sch.* - -	*Johnston, Rev. W.* -	*Lyle, Rev. S.* -	*Allen, D.* - - -	..	..	..	..	..	..	..	..	5s.
Cooraclare -	Nat. Sch. - -	O'Gorman, N. S. -	Meehan, Rev. P.	McDermott, C. -	40	71	31	..	14	23	..	..	2s. 6d.
Cork - -	Central Model Sch. -	Macnamara, Rev. A. D. - - -	- - - -	Latchford, G. D. -; Gibson, A. -; Dwyer, R. -	65	61	..	4	34	4	1 B.	..	Nil.
,, - -	Carmichael Schs. -	McOstrich, A. - -	Magill, Rev. W.	Robinson, J. -; ,, N. -	..	78	78	..	..	5	..	..	2s. 6d.
Cork - -	*St. Nicholas N. S.* -	*Webster, Rev. G.* -	*Wilson, Rev. A. B.* - -	*Crawford, J. B.* -	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
,, - -	*Sch. of Art* - -	*Hewitt, T.* - -	*Dunscombe, T. S.*	*Brenan, J.* - -	..	..	..	..	..	..	..	..	10s. per sess.
Cornmeen (co. Monaghan)	Nat. Sch. - -	Bailey, Rev. W. R. -	Fleming, T. -	McClean, W. - -	..	31	31	..	..	..	..	..	2s. 6d. ea. subject.
Cottown (co. *Down*).	*Nat. Sch.* - -	*McMinn, A.* - -	*Clarke, Rev. W.*	*Simpson, J.* - -	..	..	..	..	..	..	..	..	Nil.
Crossgar (co. *Down*).	*Nat. Sch.* - -	*Cleland, J.* - -	*Thomson, Rev. J. G.*	*Wright, J.* - -	..	..	..	..	..	..	..	..	2s. 6d.
Cullybackey (*Belfast*) -	,, - -	*Patrick, J.* - -	*Hamilton, Rev. H.*	*Craig, W.* - -	..	..	..	..	..	..	..	..	8l. 15s. total sum.
,, -	*Teesham N. S.* -	*Kirkpatrick, Rev. A. T.*	*Gray, Rev. R.* -	*Millar, J.* - -	..	..	..	..	..	..	..	..	2s. 6d.
Derrygonnelly (co. Fermanagh)	Lisded N. S. -	Reade, Rev. L. -	McNulty, Rev. T.	Magennis, P. - -	..	16	16	..	..	..	..	..	2s. 6d. ea. subject.
Derrylin (co. Fermanagh).	Kinawley N. S. -	Benison, J. J. - -	Winslow, H. M.	Doogan, P. - -	..	11	11	..	..	1	..	..	2s. 6d.
Donaghadee (co. Down).	Shore St. N. S. -	McMinn, A. - -	M'Aulay, Rev. J.	Milliken, J. - -	..	16	16	..	..	7	..	..	Nil.
Donaghadee -	*High St. N. S.* -	*McMinn, A.* - -	*M'Aulay, Rev. J.*	*Young, W. J.* - -	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.

Donoughmore (co. Down)	Lecture Room	Quinn, Rev. J. C.	Elliott, Rev. J.	Williams, T. M.	..	14	14	..	..	..	..	..	2s. 6d. ea. subject.
Downpatrick	Nat. Sch.	Pilson, C.	Clarke, J.	Fitzpatrick, S.	..	58	58	..	..	1	..	..	2s. 6d.
Drogheda	St. Mary's Inst.	Mathews, Rev. T.	McGreevy, N.	Dolan, J.	29	31	2	..	2	7	..	..	4l.
Dromara (co. *Down*)	*Court House*	*Craig, Rev. W.*	*Patton, Rev. W. J.*	*Mackintosh, J.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Dromore (*Tyrone*).	*Corbally N. S.*	*Simpson, Rev. S. H.*	*McKenna, Rev. E.*	*Donnelly, T.*	..	..	..	..	..	..	..	..	Nil.
Drumavish (*co. Donegal*).	*Nat. Sch.*	*Johnston, J.*	*Johnston, J.*	*Patterson, W.*	..	..	..	..	..	..	..	..	1s.
Drumlough (*co. Down*)	*Nat. Sch.*	*Chambers, J.*	*McClelland, Rev. J.*	*Mackintosh, J.*	..	12	12	..	..	2	..	..	2s. 6d.
Dublin	Central Model Sch.	Newell, W. H.	Butler, E.	Joyce, P. W. Smeeth, J. F.	127	213	86	..	31	7	..	..	Nil.
Dublin	*Wes. Sch., George's St. South.*	*Sibthorpe, J.*	*Ker, Rev. J.*	*Marshall, J.*	..	..	..	..	..	..	..	..	Nil.
"	*Young Men's Chr. Assoc.*	*Stanford, Rev. C. S.*	*Gibson, Rev. B.*	*Scott, J. M.*	..	..	..	..	..	..	..	..	Nil.
"	55, *Aungier St.*	*West, Very Rev. J.*	*Hackett, Rev. J. W.*	*Anderson, D.*	..	..	..	..	..	..	..	..	Nil.
Dundalk " " "	Free Library Quay St. Sch. Educl. Inst. Jocelyn St. Sch.	Neville, J.	Hesse, J.	Lyons, Michael McEwen, Hugh Leonard, T. Armstrong, G. Turner, J. W. McLoughlin, J. S.	63	90	28	..	52	52	1 G.	1 B.	3s. ea. sub.
Dundrod (co. *Antrim*).	*Nat. Sch.*	*Magill, Rev. W.*	*Sinclair, R.*	*Wallace, R.*	..	..	..	..	..	..	..	..	Nil.
Dundrum (co. *Down*).	*Endowed Sch.*	*Cuppage, Rev. A.*	*Napier, Rev. W.*	*Ringland, J.*	..	..	..	..	..	..	..	..	5s.
Dungannon	Society's House	Newton, C.	Gaussen, Rev. E. J.	Orr, J.	..	29	29	..	..	..	..	..	Nil.
Dungiven (co. *Londonderry*).	*Nat. Sch.*	*Mooney, Rev. D.*	*Morrison, R.*	*McKinty, C.*	..	..	..	..	..	..	..	..	2s. 6d.
Dunmanway	*Model Sch.*	*Bryan, J. H.*	*Hungerford, H. J.*	*Donovan, D.*	..	..	..	..	..	..	..	..	Nil.
"	*Reenoscrena, N. S.*	"	"	"	..	..	..	..	..	..	..	..	Nil.
Ederney (co. *Monaghan*).	*Moneyvrice and Agahagaffart N. S.*	*O'Reilly, Rev. J.*	*McGough, Rev. E.*	*Donnelly, T.*	..	..	..	..	..	..	..	..	Nil.
Enniskillen	Model Nat. Sch.	Greer, Rev. S.	Bagot, E.	Morris, C.	..	39	39	..	..	..	..	..	2s. 6d. to 5s.
Enniskillen	*Rossdoney Nat. Sch.*	*Rudd, Rev. T.*	*Carroll, Rev. P.*	*Doogan, P.*	..	..	..	..	..	..	..	..	2s. 6d.
Galway	Model Sch.	Persse, T. M.	Gordon, J.	Moylan, J.	43	51	8	..	5	..	..	..	Nil.
Gilford	Mill Sch.	M'Master, J. W.	Whiteside, T. R.	Martin, H.	35	40	14	..	8	2	..	..	Nil.
Grange O'Neilland.	*Parochial Sch.*	*Ard, Rev. A. J.*	*Irwin, Rev. A.*	*Baile, R.*	..	..	..	..	..	..	..	..	Nil.
Greyabbey (co. Down).	Nat. Sch.	Montgomery, H.	Hall, Rev. W.	Walker, W.	..	40	40	..	..	..	..	..	Nil.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
Hillsborough	*Boys' Sch.*	*Gibbs, Ven. J. A.*	*Phipps, Rev. O. H.*	*Read, J.*	..	..	..	..	..	..	..	..	Nil.
Holywood	Sullivan Sch.	Hunter, J.	Foster, A. F.	Speers, A.; Jenkinson, E.; Waterworth, H.	76	117	41	..	18	7	..	..	Nil.
Kilkee (co. *Clare*).	*Nat. Sch.*	*Moore, J. W.*	*McDonnell, M.*	*Devine, M. J.*	..	..	..	..	..	..	..	..	2s. 6d. to 5s.
Kilkenny	Model Sch.	Blunden, Sir J., Bart.	Montmorency, Rev. W. de.	Ryan, L. J.	46	44	..	2	9	1	..	..	2s. 6d. ea. subject.
Kilkenny	*Model Farm Sch.*	*Blunden, Sir J., Bart.*	*Montmorency Rev. W. de.*	*Ryan, L. J.*; *Deverill, R.*	..	..	..	..	..	..	..	..	2s. 6d.
"	*Pocock Inst.*												
Killinchy (co. *Down*).	*School-house*	*Ward, Rev. H.*	*Boomer, Rev. C. C.*	*Cleland, J. M.*	..	..	..	..	..	..	..	..	2s. 6d.
Killybegs (co. *Donegal*).	*Nat. Sch.*	*Barrett, W.*	*Rogers, C.*	*Ward, J. C.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Killylea (co. Armagh)	School-house	Cross, W.	Ellis, Rev. T.	Brownlee, T.; Gibson, J. W.; Anderson, J. F.	..	43	43	..	..	1	..	..	2s. 6d.
Kilmihil (co. *Clare*).	*Leitrim Nat. Sch.*	*Browne, E. B.*	*Moloney, Rev. M.*	*O'Callaghan, P.*	..	..	..	..	..	..	..	..	2s. 6d. per qr.
Kilmore (co. Armagh).	School-house	Irwin, Rev. C. K.	Paton, Rev. J.	Baile, R.	..	18	18	..	..	..	..	..	Nil.
Kircubbin (co. Down).	Nat. School-house	Lyle, Rev. E. A.	Rowan, Rev. J.	Walker, W.	..	14	14	..	..	..	..	..	Nil.
Kircubbin	*Glastry N. S.*	*Gilchrist, Rev. J.*	*Hawthorne, Rev. S.*	*McConkey, J.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Larne	Model Agric. Sch.	Porter, Rev. C.	Eccles, W.	Hay, W.	49	30	..	19	15	3	..	1 B.	5s.
Larne and Inver.	*Nat. Sch.*	"	"	*Davidson, J. G.*	..	..	..	..	..	..	..	..	5s.
Letterkenny	Nat. Sch.	Gallagher, J.	Kelly, Rev. B.	O'Donnel, H.; M'Fadden, E.	19	34	34	..	..	1	..	..	5s. ea. sub.
Ligoniel (near Belfast).	Wolfhill Mill N. S.	Montgomery, J.	Orr, W.	Barbour, S.	..	27	8	..	5	12	..	1 B.	Nil.
Limerick	*Sch. of Art*	*Spillane, W.*	*Connihan, J.*	*Brophy, N. A.*	..	..	..	..	..	..	..	..	1s. to 2s. pr. month.
Lisnagry (co. Limerick).	Ahane N. S.	Powell, C.	Bourke, R.	Casey J.	..	20	20	..	..	..	..	..	2s. 6d.

Londonderry	District Model Sch.	Smyth, Rev. R.	Dugan, C. W.	Gleeson, P. V.	..	41	41	..	..	..	..	..	25s.
Londonderry	*Gwyn's Char. Inst.*	*Darcus, H.*	*Skipton, P.*	*Cotter, E. G.*	..	..	..	..	..	..	..	..	Nil.
Lough Outra (co. Galway).	Nat. Sch.	Gough, The Rt. Hon. Viscount.	Watson, J.	Cusack, M.	..	4	4	..	..	..	..	..	8s. per ann.
Lurgan " "	Mech. Inst. Mod. Sch. Nat. Sch.	Hancock, J.	Magahan, F. W.	Porter, G. Galway, W. J. English, W.	61	104	48	..	18	2	..	..	5s. ea. sub.
Macroom (co. Cork)	*Nat. Sch.*	*Crooke, W.*	*Strong, T. K.*	*Carroll, J.*	..	..	..	..	..	..	..	..	Not yet arranged.
Magherafelt (co. Londonderry).	*Nat. Sch., No. 2*	*Montgomery, Rev. A.*	*McFall, A.*	*McMurray, S.*	..	..	..	..	..	..	..	..	Nil.
Manorhamilton	Court House	O'Donnell, J.	Shaw, S.	Birney, J.	..	30	30	..	..	..	..	..	2s. 6d.
Markethill	Coolmalish N. S.	O'Toole, Rev. D.	Cuming, Rev. W.	Nugent, F.	20	13	..	7	4	..	..	..	2s. 6d.
Millisle (co. Down).	*Nat. Sch.*	*Carmichael, D.*	*McAuley, Rev. J.*	*Simpson, M.*	..	..	..	..	..	..	..	..	2s. 6d.
Millstreet (co. Cork).	*Nat. Sch.*	*Leader, J.*	*Cronin, J. B.*	*O'Connor, T. M.*	..	..	..	..	..	..	..	..	Nil.
"	Cullin N. S.	"	"	"	..	..	..	..	..	..	..	..	Nil.
Moira (co. Down)	Brookfield Agric. S.	Richardson, J. J.	Swann, T.	Davidson, W. Pedlow, G.	..	23	23	..	..	..	..	..	Nil.
Monaghan	Model Sch.	Lloyd, J.	Eardley, F.	Lineham, P.	..	102	102	..	..	10	..	..	2s. 6d. ea. subject.
Monaghan	*Aghnalogh Nat. Sch.*	*Reilly, J.*	*O'Neill, Rev. S. J.*	*Macklin, J.*	..	..	..	..	..	..	..	..	2s. 6d.
"	*Corcaghan N. S.*	*McKenna, Rev. J.*	*Smyth, P.*	*Brennan, E.*	..	..	..	..	..	..	..	..	10s.
Moy (co. Tyrone).	*Nat. Sch.*	*Coyne, Rev. M.*	*Bradley, Rev. M.*	*Kelly, P.*	..	..	..	..	..	..	..	..	Nil.
Moyasta	*Kilrush N. S.*	*Burkitt, Rev. G.*	*Sheedy, T.*	*Burke, J.*	..	..	..	..	..	..	..	..	1s. per mo.
Mullinavatt	*Class Room*	*Hoare, Very Rev. E. N.*	*Cavet, J.*	*Cane, J. B. N.*	..	..	..	..	..	..	..	..	Nil.
Newry	Model Sch.	Dodd, Rev. J.	Porter, D. C.	Watt, W. D. O'Brien, P. T.	41	16	..	25	..	..	..	..	5s.
Newry	*Cloughoge N. S.*	*Murphy, Rev. M.*	*Donnelly, Rev. J.*	*Nugent, F.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Newtownards "	Model School East St., No. 2, N. S.	Pooler, Rev. J. G. Moore, Rev. H.	Macdonnell, J.	Harbison, M. Greer, W. H. O'Reilly, J. C.	134	148	14	..	50	..	1 G., 1 S., 1 B.	..	Nil.
				McConkey, J. Young, W. J.	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
"	Ballyblack Sch.	Parke, Rev. D.	Mitchell, Rev. W.	Anderson, J.	..	13	13	..	..	..	..	..	Nil.
Newtownards	*Loughriescouse N. S.*	*Macaulay, Rev. M.*	*Macdonnell, J.*	*Anderson, J.*	..	..	..	..	..	..	..	..	Nil.
Newtownbreda	Nat. Sch.	Kennedy, J.	Anderson, Rev. W.	Erwin, M.	33	20	..	4	..	..	..	..	2s. 6d.
Newtownlimavady	*Town Hall*	*Cather, W.*	*Brown, Rev. N. M.*	*Speers, R.*	..	..	..	..	..	..	..	..	2s. 6d. to 10s. ea. sub.
Newtownstewart.	*Model Sch.*	*MacIvor, Rev. J.*	*Gordon, F.*	*Dowling, F. M.*	..	..	..	..	..	..	..	..	2s. 6d.

List of Science Schools, giving the Number of Students, &c.—*continued.*

Town.	Where held.	Chairman.	Secretary.	Teacher.	Number of Individuals under Instruction.		Increase.	Decrease.	Number of Prizes.		Number of Medals.		Fees paid by Students.
					1868.	1869.			1868.	1869.	1868.	1869.	
Newtown-stewart.	*Lower Langfield N.S.*	*Kennedy, Rev. H.*	*Stack, Rev. T. L.*	*Clements, W. T.*	..	..	..	..	..	..	..	..	Nil.
Oldcastle	Endowed Sch.	Durdin, Rev. T. G.	O'Neill, R.	Beatty, J. Smyth, A.	190	201	11	..	26	40	1 S., 1 B.	1 S.	Nil.
Omagh	Model Sch.	Byrne, Rev. J.	Chartres, Rev. W.	Ferguson, S. H.	..	46	46	..	..	11	..	..	5s. returned at exn.
Parsonstown *Parsonstown*	" *Y. M. Chr. Assoc.*	Rt. Hon. the Earl of Rosse	Brown, S.	McManus, Wm. Hetherington, G. O'Brien, M. H.	..	25	25	..	..	5	..	..	Nil.
Portadown *Portadown*	Edenderry N. S. *Baptist Meeting House.*	Armstrong, T.	Wallace, H.	Baile, R. Martin, H. Forbes, J.	..	18	18	..	..	1	..	..	Nil.
"	*Temp. Hall*	*Shinnamore, T. W.*	*Waugh, D. W.*	*Lee, H.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Portaferry	*Nat. Sch.*	*Filson, A.*	*Orr, Rev. J.*	*Doyle, P.*	..	..	..	..	..	..	..	..	2s. 6d. ea. subject.
Portaferry (co. Down)	*Nat. Sch., No. 2*	"	"	*Begley, G. R.*	..	..	..	..	..	..	..	..	2s. 6d. for each class.
Ramelton (Letterkenny).	*Robertson's N. S.*	*Gwynn, Rev. J.*	*Mitchell, M.*	*Coyle, D.*	..	..	..	..	..	..	..	..	Nil.
Raphoe (co. Donegal).	Nat. Sch.	Weir, Rev. J. A.	Morrow, H.	Cotter, E. G.	18	6	..	12	10	..	..	..	Nil.
"	*Convoy Concert Hall*	"	"	*McCaffery, W.*	..	..	..	..	..	..	..	..	Nil.
Rathfryland	Town Hall	Smyth, Rev. E.	Meek, B. B.	Williams, T. M.	..	17	17	..	..	..	..	..	2s. 6d. ea. subject.
Rich Hill	*Ballynahinch N. S.*	*Skuse, Rev. C.*	*McCaldin, Rev. A.*	*Baile, R.*	..	..	..	..	..	..	..	..	Nil.
Roscrea (co. Tipperary)	Nat. Sch.	Meagher, Rev. J.	Somers, J. L.	McGrenahan, E. Kelly, T.	9	34	25	..	7	5	..	..	5s. each subject.
Roslea	*Greaghawarren and Deerpark Nat. Sch.*	*McKenna, Rev. J. J.*	*Keenan, J. B.*	*Cassidy, J.*	..	..	..	..	..	..	..	..	2s. 6d.
Rosscarbery (co. Cork).	Mt. Fachnanus N.S.	Lucey, Rev. J.	Mulcahy, Rev. J.	Prendergast, P.	..	40	40	..	..	..	..	..	Nil.
Santry	Trg. Inst.	West, Very Rev. J.	Hackett, Rev. J. W.	Hill, J. Smith, R. Shekelton, W.	60	91	31	..	87	4	1 S., 3 B.	..	Nil.
Scariff	Nat. Sch.	Sampson, F. C.	O'Mailly, P.	O'Gorman, T.	..	38	38	..	..	..	..	..	2s. 6d. ea. subject.

Sixmilecross (Omagh).	„	Mann, D.	Junk, Rev. T. W.	Crooks, S.	..	21	21	..	..	1	..	..	Nil.
Skibbereen (*co. Cork*).	*Nat. Sch.*	*Davis, Rev. C.*	*Shea, J.*	*Prendergast, P.*	..	..	..	..	..	..	..	..	Nil.
Sligo	*St. John's N. S.*	*Kidd, J.*	*Dowden, Rev. J.*	*Fawcett, J.*	..	..	..	..	..	..	..	..	2s. 6d. per month.
Stewartstown (co. Tyrone).	No. 2 Nat. Sch.	McCurdy, Rev. S.	Harkness, Rev. J. N.	Campbell, W.	..	24	24	..	..	..	..	..	Nil.
Strabane (*co. Tyrone*).	*Town Hall*	*White, O.*	*Leney, A.*	*Patterson, W.*	..	..	..	..	..	..	..	..	2s. 6d. to 10s.
„	*Par. Sch., Church St.*	„	„	*Matthews, C.*	..	..	..	..	..	..	..	..	2s. 6d.
Strabane	*Tullyrchisker Sch.*	*Seymour, Rev. C.*	*McConaghey, Rev. J.*	*Colhoun, C.*	..	..	..	..	..	..	..	..	Nil.
Templepatrick (*co. Antrim*).	*Lylehill N. S.*	*Hamilton, Rev. H. M.*	*Black, Rev. J.*	*Stronge, J.*	..	..	..	..	..	..	..	..	1s. 6d.
Trim	Model Sch.	Lightburne, H.	Conwell, E. A.	Freehill, M.	62	96	34	..	28	7	..	..	Nil.
Tulla (*co. Clare*)	*Nat. Sch.*	*O'Callaghan, C. G.*	*O'Donovan, Rev. M.*	*O'Brien, J.*	..	..	..	..	..	..	..	..	2s. 6d. per quarter.
Tullamore	*Charleville Sch.*	*Pierce, T. H.*	*Craig, Rev. G.*	*Bateman, T.*	..	..	..	..	..	..	..	..	Nil.
Waterford	Model Sch.	Hoare, Very Rev. E. N.	Cavet, J.	Dowling, J. Garnett, E.	55	34	..	21	8	2	..	..	5s. to 7s. 6d. ea. subj.
„	Newtown Sch.	„	„	Cane, J. B. N.	..	43	43	..	..	..	..	..	Nil.
					11,925	21,669	9744	—	3,245	1,854			

TABLE II.

15. TABLE showing the CLASSES in each of the preceding SCIENCE SCHOOLS, the SUBJECTS taught, and the NUMBER of STUDENTS in each Subject. March 1870.

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
								ENGLAND.																	
Abingdon -	British School	50	..	..	..	..	..	..	..	..	6	16	..	..	..	26	..	..	..	..	..	..	..	..	2
Accrington -	Mechanics' Institution	50	6	19	13	25	..	..	..	3	6	14	..	..	..	7	..	..	..	..	..	..	..	..	15
" -	25, Bridge Street	10	..	..	..	..	..	..	..	..	10	10	..	..	..	10	..	..	..	..	..	..	..	..	..
" -	Christ Church National School.	10	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..
Alderley Edge -	Reading Room and Library	7	4	4	4	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Almondbury -	Grammar School	17	..	..	..	10	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..
Alnwick -	Mechanics' Institution	12	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8
Andover -	Grammar School	30	..	..	..	..	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	30
Armley -	Church School	1	..	..	..	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ashby-de-la-Zouch -	Mutual Improvement Society	34	..	..	..	..	..	..	..	..	16	21	..	..	..	..	..	..	8	..	..	..	..	..	..
Ashton-under-Lyne	Mechanics' Institution	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	St. Michael's Young Men's Christian Association.	45	13	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	45
" -	Hurst Mech. Institution	10	10	10	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Dukinfield Village Library	16	..	..	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..
" -	Dukinfield Old Chapel Sunday School.	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bacup -	Mechanics' Institution	45	19	19	19	..	..	..	12	..	..	16	..	..	..	14	..	..	..	..	..	..	..	..	..
" -	Wesleyan Day School	40	..	..	..	..	..	..	..	..	..	..	..	..	..	40	..	..	..	..	..	..	..	..	..
Backworth -	Old Chapel	30	30	30	30	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Balham -	Working Men's Institution	14	14	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Banbury -	British School	18	..	..	..	8	..	6	..	16	..	..	..	..	..	12	10	..	..	..	..	..	..	..	..
" -	Mechanics' Institution	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..
Bangor -	Normal College	30	..	..	..	25	..	25	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..
Banstead -	School-room	32	..	..	..	..	..	..	..	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	27

Barnard Castle	**Mechanics' Institution**	23	..	13	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..
Barnsley	**Mechanics' Institution**	12	8	..	..	..	..	..	..	6	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Barnstaple	Literary and Scientific Institution.	65	..	..	..	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15
Bath	Weston Boys' School	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16
„	St. Mark's National School, Lyncombe.	21	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21
Batley	Mechanics' Institution	18	6	..	..	..	..	..	..	..	14	17	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Independent School	20	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Beccles	Leman School-room	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7
Bedlington	Colliery School	27	27	27	27	..	..	..	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bedford	Commercial School	23	..	..	..	..	..	..	..	..	..	..	..	..	..	23	..	..	..	..	..	..	..	..	18
Berkeley	Church of England School	15	..	..	..	..	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..
Bingley	Mechanics' Institution	13	..	..	..	..	..	..	..	5	6	10	..	..	..	..	..	..	..	..	..	..	..	..	..
Birkenhead	School of Art	30	20	8	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Hamilton School	15	..	..	..	..	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..
Birmingham	Midland Institute	194	11	..	..	..	..	..	..	21	..	152	..	..	..	8	..	13	..	..	..	..	..	..	52
„	School of Art	82	22	54	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Clarendon Chambers	38	..	14	16	..	..	..	..	10	15	..	..	..	..	3	..	..	..	..	..	..	..	..	..
„	Bloomsbury Institution	60	9	20	12	..	..	..	..	5	5	5	..	5	..	16	..	..	..	..	..	..	..	..	22
„	Graham Street Institution	22	..	..	..	..	..	..	..	14	14	..	..	..	..	11	..	..	..	..	..	..	..	..	7
„	Church of the Saviour School.	13	..	..	..	..	..	..	..	13	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	St. George's School	28	..	..	..	..	..	..	..	..	..	..	..	27	..	..	..	..	..	..	..	..	..	..	24
„	St. Paul's School	91	..	34	19	..	..	..	..	..	40	54	..	..	..	..	..	..	..	..	..	..	..	..	..
„	St. Mary's School	35	..	15	15	..	..	..	..	9	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	St. Mark's School	41	..	15	15	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	32
„	St. Clement's School	18	..	..	..	..	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	18
„	Deritend Working Men's Association.	22	12	..	..	14	..	..	..	7	15	..	..	..	..	13	..	..	..	..	..	..	..	..	..
„	New Jerusalem School	9	..	..	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..
„	Middle Class School	48	12	12	12	..	..	..	..	..	..	44	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Bishop Ryder's School	17	14	..	..	7	..	..	..	..	..	17	..	..	..	14	..	..	..	..	..	..	..	..	..
„	Blue Coat School	18	..	..	..	..	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..
„	Wesleyan School	10	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..
„	Friends' Bible Association	19	..	..	..	..	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..	..
„	Trade School	30	..	..	..	..	..	..	..	..	30	..	..	..	..	30	..	..	..	..	..	..	..	..	..
„	St. Matthias' School	27	..	..	..	..	..	..	..	..	23	..	..	..	..	26	..	..	..	..	..	..	..	..	..
„	Steelhouse Lane School	20	..	..	..	..	..	..	..	..	20	..	..	..	..	20	..	..	..	..	..	..	..	..	..
„	Mutual Improvement Society	16	..	..	..	..	..	..	..	..	31	30	..	..	..	..	..	..	..	..	..	..	..	..	..
Birstall	Mechanics' Institution	29	..	..	..	..	..	..	..	28	22	21	..	..	..	..	..	..	..	..	..	..	..	..	28
Bishop Auckland	Wesleyan School	35	..	..	..	..	..	..	..	..	..	35	..	..	..	..	..	..	..	..	..	..	..	..	..
Bishop's Stortford	Literary Institution	10	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Blackburn	Wesleyan School	54	..	..	..	..	..	..	..	9	13	23	..	..	..	40	..	..	..	..	..	..	..	..	24
„	Church Institution	13	..	..	..	..	..	..	..	12	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
„	Town Hall	8	8	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Blackley	Assembly Rooms	24	24	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Blyth	National School	15	15	15	15	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bodmin	Literary Institution	21	..	..	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	5
Bolton	Science and Art School	120	30	30	30	10	..	15	15	12	12	35	..	6	..	40	..	..	..	..	..	..	..	5	25
"	Mechanics' Institution	70	60	55	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Dean Mills B. S.	15	15	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Unitarian School	11	..	..	..	..	..	..	..	..	11	..	..	..	..	10	..	..	..	..	..	..	..	..	..
Boston	National Schools	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9	..	..	16
"	School of Art	16	3	14	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bradford	Mechanics' Institution	27	..	..	..	..	..	..	..	..	15	20	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Builder's Technical School	19	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Hallfield School	15	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Wesleyan School	18	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..
Bramley	Grove House	13	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..
Breage "	Literary Institution Germoe National School	17	..	..	..	..	..	..	..	..	..	17	..	8	17	..	..	..	..	..	..	..	..	..	..
Bredbury	St. Mark's National School	64	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	64
Bridport	Literary and Scientific Institution.	7	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Brigstock	Farming Woods' School	30	..	..	..	..	..	..	..	5	20	..	..	..	..	30	..	..	..	..	..	..	..	..	..
Brington	National School	9	..	..	..	7	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bristol	Trade and Mining School	256	107	110	95	85	..	55	55	19	74	118	87	..	..	..	..	19	19	6	..	..	..	..	..
"	Young Men's Christian Association.	93	10	10	..	..	..	..	..	8	6	21	21	10	..	66	..	..	..	..	..	..	..	..	..
"	Wesleyan School	50	50	..	50	..	..	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..
Brixham	British School	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..
Bromsgrove	Literary and Mechanics' Institution.	26	..	..	..	..	..	..	..	..	..	26	..	..	..	25	..	..	..	..	..	..	..	..	..
Burnley	Literary Institution	58	..	31	32	..	..	..	12	..	..	8	..	..	..	6	..	8	..	..	..	..	..	..	..

"	Carlton Road School	55	..	..	..	..	..	..	..	..	..	55	..	..	..	20	..	..	..	..	..	..	..	..	..
"	Mechanics' Institution	69	20	45	45	..	..	..	4	..	..	6	..	..	..	34	..	..	..	..	..	..	..	..	6
"	Grammar School	40	..	..	..	20	..	..	..	..	..	40	..	20	..	..	..	..	..	..	..	..	..	..	..
"	St. Peter's School (Schoolmaster's Class).	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Burslem	Wedgwood Institution	48	8	8	8	..	..	..	..	..	..	40	..	..	..	..	..	..	..	..	..	..	..	..	..
Bury	Athenæum	55	55	50	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Caistor	Lower Grammar School	22	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	18
Calverley	Mechanics' Institution	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Camborne	Literary Institution	15	..	..	..	..	..	..	..	..	..	15	..	..	15	..	..	..	..	..	..	..	..	..	..
Canning Town	Holy Trinity School	24	24	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cardiff	Free Library	40	18	18	18	10	..	12	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Carharrack	Literary Institution	17	..	..	..	..	..	..	..	..	..	17	..	..	17	..	..	..	..	..	..	..	..	..	..
Carmarthen	Training College	30	..	..	..	30	..	30	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30
Charlesworth	Mechanics' Institution	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Charlton, New	Mathematical Instrument Works' School.	22	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chatham	St. Mary's School	34	32	33	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Mark's, New Brompton	28	24	24	{23 5*}	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cheltenham	Training College	60	..	..	..	60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	60
"	{Young Men's Christian Association; British School}	56	..	..	..	..	..	..	..	..	..	..	..	..	..	56	..	..	..	..	..	..	..	..	..
"	Whitworth School	212	..	..	..	13	..	5	5	24	173	24	24	35	..	56	13	19	..	..	7	..	..	..	9
Chester	School of Science and Art	26	20	15	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chesterfield	National School	21	18	18	8	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chorley	St. George's National School	10	5	10	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Church	National School	47	..	..	..	..	..	..	..	..	19	40	..	..	..	45	..	..	..	..	..	..	..	..	..
Cirencester	School of Art	12	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Clay Cross	Public Hall	53	50	30	20	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Coalbrookdale	Literary and Scientific Institution.	26	26	15	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Colne	Grammar School	16	..	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Compstall	Athenæum	30	14	14	14	..	..	..	..	..	..	10	..	..	..	16	..	..	..	..	..	..	..	..	..
Cottesmore	National School	16	..	..	..	..	..	..	..	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Coventry	St. Peter's National School	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	22
Crawshawbooth	Mechanics' Institution	23	23	23	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Crewe	Mechanics' Institution	26	25	26	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Croydon	Literary Institution	16	15	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Andrew's National School.	8	8	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Culham	Training College	20	16	..	..	16	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	20
Dartmouth	National School	24	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

* Naval Architecture.

...g the Classes in each of the preceding Science Schools, &c.—continued.

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Darwen -	Mechanics' Institution -	28	28	28	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Daventry -	Grammar School -	20	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Deptford -	St. Paul's School -	65	37	37	37	34	..	34	33	..	..	..	..	..	..	..	..	..	..	..	..	..	..	33	..
" -	St. John's School - }	14	14	..	..	9	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8	..
" -	St. John's Mission Hall - }																								
Derby -	Grammar School -	7	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..
Devonport -	Mechanics' Institution -	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	5	..	..	..	..	..	..
" -	14, St. Aubyn Street* -	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dewsbury -	Mechanics' Institution -	58	14	..	..	..	..	..	..	11	11	11	11	..	..	..	..	..	..	..	..	..	..	..	..
" -	Wesleyan Literary Society -	8	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..
Doncaster -	Guildhall - -	28	28	13	11	4	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Great Northern Railway School.	60	..	60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Droitwich -	National School -	30	..	..	..	..	..	..	..	..	..	25	..	..	..	30	..	..	..	..	..	..	..	..	..
Droylsden -	Educational Institution -	40	32	32	32	..	..	..	..	..	..	15	15	..	..	..	..	..	..	..	..	..	..	..	..
Dudley -	Mechanics' Institution -	28	10	9	2	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Blue Coat School -	48	..	..	..	..	..	..	..	..	..	48	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Netherton National School -	18	..	..	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	18
Dunstable -	Ashton School -	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30
Eagley -	Institute - -	18	..	..	..	..	..	..	..	..	..	8	..	..	..	18	..	..	..	..	..	..	..	..	..
Earlestown -	Infant School -	20	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	London and North-Western Railway Library and Reading Room.	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Eastington -	National School -	10	..	10	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Eastwood -	Mechanics' Institution -	18	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Eccleshill -	Mechanics' Institution -	10	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..
Elland -	National School -	16	16	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Elsecar - -	National School - -	21	..	..	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..
Brith - -	National School - -	19	19	91	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Evesham - -	Bengeworth, Deacle's School	19	..	..	..	..	..	..	..	..	9	..	..	..	..	18	..	..	..	..	..	..	..	..	..
Exeter - -	Albert Memorial Institution	56	..	..	..	13	..	..	..	..	..	18	..	24	..	8	..	12	12	..	..	..	..	..	..
Failsworth - -	Mechanics' Institution -	29	29	29	29	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Farnworth - -	Grammar School - -	36	36	24	24	20	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Wesleyan School - -	58	58	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	St. James' School, Newbury	22	..	..	..	..	..	10	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..
" - -	Halshaw Moor School -	15	15	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Faversham - -	Institute - - -	29	..	..	..	..	..	..	..	..	..	12	..	..	..	25	..	..	..	..	..	..	..	..	..
Finedon - -	Temperance Hall - -	32	..	..	..	..	..	..	..	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Frampton-on-Severn	National School - -	7	..	..	7	..	..	..	..	..	..	..	..	7	..	7	..	..	..	..	..	..	..	..	..
Friezland - -	Christ Church Institution -	17	17	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Frome - -	School of Art - - -	20	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Blue Coat School - -	22	..	..	..	..	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Garforth - -	Working Men's Club -	7	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..
Gateshead - -	National School - -	49	30	30	30	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	30	..
" -	Boys' Schoolroom, Felling Chemical Works.	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gee Cross - -	Hyde Chapel School -	20	16	16	16	..	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..
Gildersome -	Literary Institution -	9	..	..	..	..	..	..	..	..	9	9	..	..	..	..	..	..	..	..	..	..	..	..	..
Glossop - -	Littlemoor Mechanics' Institution.	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gloucester - -	10, Eastgate Street - -	37	..	..	..	20	..	..	..	22	21	20	20	18	..	14	..	12	..	..	..	..	..	..	..
" - -	School of Art - - -	20	12	6	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gomersal - -	Mechanics' Institution -	10	..	..	..	..	..	..	..	..	10	10	..	..	..	..	..	..	..	..	..	..	..	..	..
Gorton - -	Manchester, Sheffield, and Lincolnshire Railway Institution.	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Grantham - -	National School - -	29	..	..	..	9	..	2	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..
Great Harwood -	National School - -	24	..	..	..	..	..	..	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..
Great Horton -	Wesleyan School - -	24	..	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Greenwich - -	St. Mary's National School	20	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Mechanics' Institution -	15	12	12	12	..	..	..	..	..	..	6	..	6	..	..	..	..	..	..	..	..	..	..	..
Guildford - -	County Hall - - -	45	..	..	..	12	..	19	..	10	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..
Halifax - -	Working Men's College -	45	14	..	..	..	..	..	..	..	..	32	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Mechanics' Institution -	15	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	School of Art - - -	10	10	5	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hammersmith -	Training College - -	38	..	..	..	38	..	..	..	38	..	..	..	..	..	38	..	..	..	..	..	..	..	..	..
Hampton - -	Commercial School - -	20	..	20	..	..	..	..	..	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..
Handsworth -	St. Michael's Association -	9	..	..	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	9
Harborne - -	Young Men's Christ. Assoc.	15	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Smethwick National School	26	..	..	..	..	..	..	..	..	..	..	..	..	..	26	..	..	..	..	..	..	..	..	..

* Return included with Charles School, Plymouth.

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Haslingden	Institute	26	..	..	..	..	..	..	4	..	..	10	..	..	..	25	..	..	..	..	..	..	..	..	..
Hayfield	Birch Vale Institution	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Helston	Grammar School	12	..	..	..	..	..	..	..	..	..	12	11	11	..	..	..	..	..	..	..	..	..	..	..
Hereford	Blue School	100	..	..	..	20	..	..	..	40	100	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hetton	Colliery School	25	25	25	25	..	..	10	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..
Heywood	Mechanics' Institution	30	15	15	15	..	..	..	..	..	9	13	13	..	..	..	..	..	..	..	..	..	..	..	..
Highgate	National School	16	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..
Hingham	National School	24	..	..	..	..	..	14	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	12
Holbeck	Mechanics' Institution	24	21	21	21	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Wesleyan School	45	..	..	..	..	..	..	..	..	45	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Holmfirth	Working Men's Club	14	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..
Hornsey	British School	36	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	36
Horwich	National School	22	22	22	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Huddersfield	Mechanics' Institution	53	27	29	29	..	..	..	..	22	22	33	6	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Paul's School	30	30	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Milnsbridge Mech. Inst.	11	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hull	Nautical School	68	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	68	68	30	30
"	People's Institution	75	54	54	54	8	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	8	..
"	Day Street British School	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Huntingdon	Walden's School	9	..	..	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..
Hyde	Mechanics' Institution	36	9	9	9	..	..	..	..	..	12	9	..	..	..	9	..	..	..	..	..	..	..	..	..
Ipswich	Working Men's College	50	6	6	10	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	..	..	..	..	..
Jarrow-on-Tyne	Mechanics' Institution	55	47	47	47	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Keighley	Mechanics' Institution	6	4	2	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kendal	Post Office Yard Room	52	..	..	..	6	..	..	..	..	..	32	..	..	..	30	..	..	..	..	..	..	..	..	..
Kearsley	British School	13	..	..	..	..	..	..	..	..	..	13	..	..	..	13	..	..	..	..	..	..	..	..	..

Kettering	National School	20	..	..	..	..	..	..	..	16	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	British School	30	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kilburn	St. Mary's School	24	24	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kinver	Wire Mill	14	..	..	..	..	..	..	..	..	..	14	2	..	..	14	..	..	..	..	..	..	..	..	..
Kirkstall	St. Stephen's School	4	..	..	..	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..
Lamerton	Church of England School	21	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21
Lamport	Endowed School	28	..	..	..	..	..	..	..	22	28	..	..	..	..	28	..	..	..	..	..	..	..	..	..
Lancaster	Mechanics' Institution	66	..	..	..	20	..	..	..	..	..	24	..	..	..	9	..	..	..	..	..	..	..	..	33
„	National School	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	50
„	School of Art	13	12	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Launceston	Grammar School	13	..	..	..	..	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	13
Leeds	Mechanics' Institution and Literary Society.	72	..	..	..	20	..	..	..	..	..	42	7	..	..	..	..	..	..	..	8	..	..	..	..
„	St. Peter's School	60	..	..	..	..	..	..	..	..	..	48	..	..	..	..	..	..	..	..	..	..	..	..	50
„	Young Men's Christian Association.	33	..	..	..	3	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Working Men's Institution	21	21	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Hunslet Mechanics' Institution.	9	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..
„	St. Mark's National School	18	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..
„	St. Simon's School	21	..	..	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Art and Science Institution	44	21	21	21	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..
„ „	Lancasterian School (for Schoolmasters). Art and Science Institution (for Schoolmistresses).	34	16	16	16	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
„	School of Art	40	..	40	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lees	Parish Church School	18	16	18	18	..	..	9	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Leicester	St. Martin's School	103	..	29	..	53	..	..	..	..	41	14	14	..	..	..	..	..	..	..	..	..	..	..	..
„	St. Margaret's School	21	..	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Belgrave National School	26	..	..	..	..	..	..	..	6	26	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Great Meeting School	33	..	..	..	..	..	..	..	..	28	..	..	..	..	31	..	..	..	..	..	..	..	..	..
Leigh	Christ Church School, Pennington.	8	..	..	..	..	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..
Leighton Buzzard	Working Men's Society	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Lewes	School of Art	9	..	..	9	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..
Limehouse	St. John's National School	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lincoln	School of Art	20	20	10	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Training School	45	..	..	..	..	..	..	..	..	..	..	..	..	..	45	..	..	..	..	..	..	..	..	..
Lindley	Mechanics' Institution	20	..	..	..	..	..	..	..	..	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..
„	National School	18	..	..	..	..	..	..	..	..	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..
Liskeard	Literary Institution	47	..	..	..	..	..	..	..	..	..	14	..	..	..	33	..	..	..	..	..	..	..	..	..
Littleborough	Church Schoolroom	7	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Liverpool	Free Library and Museum	134	..	30	..	37	..	23	..	26	33	41	..	22	..	19	..	14	..	..	..	..	..	33	..
„	Institute	144	..	..	..	97	..	..	19	..	..	112	..	..	..	..	..	..	..	..	..	..	..	19	83

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Liverpool -	Training College -	68	..	..	..	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	68
Llanboidy -	National School -	20	..	..	..	12	..	..	..	..	20	..	..	..	..	20	..	..	..	..	..	..	..	..	..
Llanelly -	Copper Works School -	64	19	28	28	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	5	..	32
" -	Loughor National School -	9	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..
London:—																									
Battersea -	St. John's College -	80	..	..	..	80	..	..	..	..	..	..	..	..	..	80	..	..	..	..	..	..	..	..	80
" -	Christ Church School -	60	..	..	..	..	..	..	..	..	..	..	..	..	..	60	..	..	..	..	..	..	..	..	..
" -	Wesleyan Chapel -	18	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	St. John's National School -	25	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bayswater -	St. Matthew's Parochial School.	50	..	..	..	..	..	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..
Bermondsey -	Christ Church School -	17	17	17	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bethnal Green -	Birkbeck School -	83	..	..	..	30	..	..	..	..	55	34	..	..	..	55	..	..	..	..	..	..	..	..	55
" -	National School -	150	21	18	..	12	..	..	..	84	36	25	..	..	..	104	..	..	..	..	..	..	..	..	96
" -	British School -	66	..	66	66	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	St. James the Less National School.	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Blackfriars Road	South London Working Men's College.	34	22	22	..	8	..	6	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..
Boro' Road -	Training College -	100	..	..	..	100	..	45	..	..	..	85	..	..	..	..	..	..	..	..	..	..	..	..	100
" -	Boys' Model School -	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	50
Bow, North -	Old Ford Road School -	25	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Brixton Hill -	Working Men's Club -	13	13	13	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Camberwell -	St. Matthew's Institution -	13	13	13	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Chancery Lane -	Birkbeck Literary and Scientific Institution -	170	45	45	45	16	21	14	12	..	30	30	..	..	..	18	..	..	..	..	..	..	..	11	31
Charterhouse -	St. Thomas' School -	200	25	20	20	..	..	..	..	..	6	..	..	..	..	80	..	..	..	..	..	..	..	..	60
Chelsea -	St. Mark's College -	88	50	..	..	88	..	39	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	88

"	Technical School	164	107	123	125	81	..	31	23	78	78	74	..	66	..	81	..	8	..	..	..	..	..	..	65
City Road	Finsbury College	25	..	..	..	..	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..
Clapham	Christ Church School	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. James' School	15	15	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Clerkenwell	Technical School	15	..	12	12	..	..	..	12	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Peter's School	15	15	15	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Eaton Square	St. Peter's Collegiate School	88	..	..	..	58	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..	..	..	..	..
Edgeware Road	Christ Chapel Boys' School	60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	60
Goswell Road	St. Barnabas' National School.	14	14	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gray's Inn Road	St. Bartholomew's School	33	..	..	..	..	..	..	..	..	..	33	..	..	..	33	..	..	..	..	..	..	..	..	..
Hackney, South	National School	29	15	..	..	..	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..
"	St. Thomas' Square School	152	25	..	..	30	..	..	..	..	..	..	..	93	..	90	..	..	..	..	..	..	..	..	70
"	Parochial School	14	14	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Peter's Boys' School	25	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hampstead Road	St. James' National School	26	..	..	..	..	..	..	..	..	26	..	..	..	..	23	..	..	..	..	..	..	..	..	..
Haverstock Hill	Orphan Working School	50	..	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..	..	..	..	..
Islington, Lower	Public School	181	47	41	..	34	..	..	..	..	102	45	..	..	..	29	..	76	..	..	..	..	..	..	76
"	St. Thomas' School	55	12	..	26	..	..	..	..	..	5	28	..	..	..	25	..	..	..	..	..	..	..	..	..
"	Wesleyan School, Mintern Street.	33	33	33	33	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Youths' Institution	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kensington	School Building, Allen Street	25	..	20	24	..	..	..	24	..	..	..	..	20	..	20	..	..	..	..	..	..	..	..	..
Kentish Town	Gospel Oak School	181	90	..	..	..	..	..	..	..	..	..	..	..	..	160	..	..	..	..	..	..	..	..	..
Kingsland	North London School of Art.	10	10	1	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Knightsbridge	Albert Working Men's Club	12	11	11	..	..	..	..	..	..	..	10	..	9	..	9	..	..	..	..	..	..	..	..	19
Lambeth	Boys' School, Hercules Buildings.	187	20	79	79	..	..	..	..	..	..	..	..	78	..	..	..	..	..	..	..	..	..	..	75
"	School of Art	28	12	11	10	..	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..
"	Lambeth Baths	25	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Peter's School	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Wesleyan School	16	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	16
Leadenhall Street	City of London College	84	..	26	..	20	..	..	..	..	..	29	..	..	18	..	..	..	..	..	..	..	..	..	..
Long Acre	Wilson Street	8	..	..	..	..	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..
Marylebone	Central Boys' School	70	..	..	..	..	..	..	..	..	..	..	..	50	..	40	..	50	..	..	..	..	..	..	70
"	New Quebec Club and Institution.	6	6	6	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nine Elms	Lecture Room	23	16	18	18	..	..	..	17	..	..	14	..	14	..	..	..	..	..	..	..	..	..	..	..
Notting Hill	Tabernacle School	28	..	..	..	..	..	..	..	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	..
Old Kent Road	St. Mary's School	76	..	..	..	..	..	..	..	..	..	..	..	..	..	76	..	..	..	..	..	..	..	..	..
Paddington	Greville House	14	14	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	All Saints' National School	50	..	..	..	..	..	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..
Peckham	St. Mary's College	54	54	54	..	..	..	..	..	54	54	..	..	..	..	..	..	..	..	..	..	..	..	..	54
Pimlico	St. Gabriel's and St. Saviour's School.	40	40	40	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
London—*cont.*																									
Poplar	All Saints' National School	39	39	39	39	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	William Street Young Men's Christian Association.	25	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..
Regent Street	Royal Polytechnic Institution.	39	..	..	..	..	..	..	..	3	9	16	..	..	..	7	..	..	..	..	4	..	..	..	..
Somers Town	National School	17	17	17	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	British School	88	88	88	88	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Spitalfields	School of Art	12	12	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Southwark	Swan Street Boys' National School.	23	23	23	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
St. John's Wood	Catholic School	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tottenham Court Road.	St. John's School	22	..	12	12	..	..	..	..	..	..	11	..	11	..	..	..	..	..	..	..	..	..	..	..
Vauxhall	Baptist School	35	35	35	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	London and South-Western Railway Institution	16	16	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Walham Green	St. John's School	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Wandsworth	Royal Patriotic Fund Boys' School.	67	..	44	..	..	..	..	..	67	67	..	..	..	..	66	..	..	..	..	..	..	..	..	66
Waterloo Road	St. John's School	56	56	56	56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Westminster	Wesleyan Training College	144	..	..	..	76	..	..	..	..	..	76	..	..	..	..	..	..	..	..	..	..	..	..	144
„	St. James-the-Less National School.	27	27	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Working Men's Club	33	26	26	..	..	..	..	..	..	..	33	..	14	..	15	..	..	..	..	..	..	..	..	..
Luddenden Foot	Day School-room	50	..	..	..	36	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..
Lutterworth	Cottage School, Coventry Road.	18	..	..	..	..	..	..	..	18	18	..	..	..	..	18	..	..	..	..	..	..	..	..	..

Macclesfield - -	Modern Free School - -	38	..	..	..	..	..	..	..	..	..	38	..	..	..	..	..	..	..	..	..	..	..	..	..
Manchester - -	Rusholme Public Hall and Library.	12	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Mechanics' Institution -	217	114	114	114	20	..	21	18	21	26	26	6	9	..	67	..	..	..	..	..	..	..	..	60
" - -	St. Luke's, Cheetham -	12	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
" - -	Free Grammar School -	151	90	90	90	..	..	60	..	130	80	90	30	..	..	..	..	60	..	..	..	..	..	..	60
" - -	Roby Society School -	12	10	6	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Building Trades Institution	72	42	..	30	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	St. George's National School	6	6	6	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Hulme, Working Men's Institute.	34	16	16	..	..	..	..	..	..	..	6	6	..	..	4	..	5	..	..	..	..	..	..	..
" - -	Mechanics' Institution and Owen's College.	120	56	56	56	24	..	..	..	..	..	60	..	..	..	82	..	..	..	..	..	..	..	..	..
" - -	Presbyterian School, Ancoats	11	11	11	11	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..
Market Harborough	British School - -	6	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" "	National School - -	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Marple - -	Albert School - -	16	16	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Melksham - -	British School - -	20	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..
Meltham - -	Church School - -	19	19	..	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Melton Mowbray -	Church School-room -	8	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..
Merthyr Tydvil -	Tydvil School - -	42	35	..	..	33	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Middlesborough -	St. John's School - -	8	..	..	..	..	..	..	..	8	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..
Middleton - -	National School - -	14	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..	10	..	..	..	..	..	..	..
" - -	Holy Trinity, Parkfield -	20	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	10
Millwall - -	Presbyterian School - -	16	16	..	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..
Mirfield - -	Literary and Scientific Society.	13	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..
Morley - -	British School - -	17	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..
Mossley - -	Mechanics' Institution -	12	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Moulton - -	National School - -	12	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Mowcop - -	National School - -	8	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Murton - -	Colliery School - -	35	35	35	35	..	..	..	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nailsworth - -	National School-room -	4	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..	4	..	..	..	..	..	..	..
Nelson-in-Marsden -	Lomeshaye Mills Schools -	27	25	25	25	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..
Newark-on-Trent -	Mechanics' Institution -	19	..	..	..	..	..	..	..	6	..	11	..	..	..	6	..	..	..	..	..	..	..	..	..
Newcastle-on-Tyne	Elswick Works Mechanics' Institution.	126	85	85	85	..	15	27	27	30	30	30	..	..	..	..	..	..	..	..	..	..	..	27	..
" "	Mechanics' Institution, New Bridge Street.	53	50	50	50	..	..	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..
" "	Stephenson Institution -	40	40	40	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" "	School of Art - - -	35	15	10	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Newcastle - under - Lyne.	School of Art - - -	14	10	3	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Newton Heath -	All Saints School - -	12	..	..	..	4	..	..	..	..	..	12	..	..	..	6	..	..	..	..	..	..	..	..	..
Northallerton -	Institution - - -	8	..	..	..	..	..	..	..	6	..	4	..	..	..	2	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Northampton	Museum	120	..	..	..	..	..	..	..	33	25	80	..	..	..	12	..	..	..	..	..	..	..	..	96
"	St. Sepulchre's National School.	16	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..
North Ormesby	Church Institute	12	..	10	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..
North Shields	Free Library	71	53	53	53	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..
"	St. Peter's School	61	61	61	61	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nottingham	Mechanics' Institution	227	..	..	..	..	..	..	..	..	25	30	..	13	..	20	..	..	..	..	..	..	..	..	150
Norwich	Presbyterian School	65	..	..	12	21	..	..	..	..	..	..	..	40	..	..	..	..	..	..	..	..	..	..	..
"	Thorpe Hamlet Boys' School	16	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11
Oadby	National School	7	..	..	..	..	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..
Oldbury	National School	84	..	60	..	..	..	..	..	..	59	81	..	54	..	54	..	..	..	..	..	..	..	..	..
"	Messrs. Chance's Institution	62	..	..	..	..	..	..	..	..	..	..	..	..	..	62	..	..	..	..	..	..	..	..	62
Oldham	Science and Art School	75	55	50	30	19	..	12	15	..	..	..	..	..	..	..	..	10	4	..	..	..	..	13	..
"	Glodwick Mutual Improvement Society.	20	18	19	20	..	..	9	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Analytic Literary Institution.	41	33	33	33	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Werneth Mechanics' Institution.	24	24	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Openshaw	Ashbury Works	28	27	28	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Wesleyan Day School	18	18	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Oswaldtwistle	Wesleyan School	75	..	..	..	..	..	..	..	..	..	..	..	..	..	51	..	..	..	..	..	..	..	..	75
"	Busk School	50	..	..	..	..	..	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..
Oundle	British School	55	..	..	..	..	..	..	..	..	..	..	..	..	..	55	..	..	..	..	..	..	..	..	..
Oxford	Univ. Mus., Art Sch. and	49	..	..	10	14	..	..	..	..	..	20	..	..	..	15	..	..	..	..	..	..	..	..	..
"	Wesleyan School	25	..	..	..	..	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..
Padiham	National School	32	20	32	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

"	Wesleyan School	47	..	..	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	43
Patricroft	Mechanics' Institution	58	18	18	18	..	..	..	5	44	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pavenham	Church of England School Room.	25	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	25
Pembroke Dock	Mechanics' Institution	16	..	..	..	16	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Pendeen	National School	16	..	..	..	..	..	..	..	..	..	16	..	..	16	..	..	..	..	7	..	..	..	..	..
Pendleton	Mechanics' Institution	21	4	17	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Penzance	School of Science and Art	33	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8
"	Sancreed Nat. Sch	5	..	..	..	..	..	..	..	..	..	..	..	..	..	5	..	..	..	..	..	..	..	..	..
Peterborough	St. Peter's College	43	..	..	..	9	..	..	..	..	..	..	..	..	..	34	..	..	..	..	..	..	..	..	43
Pitsford	National School	15	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Plumstead	Burrage Road School	104	50	50	50	..	..	..	..	..	..	..	..	..	42	..	..	..	..	..	..	..	..	..	..
"	St. James's School	103	83	83	83	20	..	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20	..
Plymouth	Courtenay Street Science School.	208	40	22	{ 8 *9 }	43	6	6	4	3	23	39	8	..	..	3	3	12	12	..	..	..	..	..	10
"	Charles National School	133	14	61	{ 43 14* }	32	..	7	10	40	..	..	..	..	..	..	..	..	..	..	..	10	3	25	64
"	Navigation School	6	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	2	..	..
Portland	The Grove School	14	..	..	..	10	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Portsmouth and Gosport.	National School	26	..	..	15*	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Preston	Institution, Avenham	25	13	9	5	..	..	..	..	..	..	11	..	..	..	6	6	..	..	..	..	..	..	..	..
Queensbury	National School	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Rawtenstall	Mechanics' Institution	31	31	31	31	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Irwell Institution	35	..	..	..	..	..	..	..	13	..	..	..	..	..	12	..	..	..	..	..	..	..	..	35
Reading	School of Art	25	15	10	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Redditch	Literary and Scientific Institution.	17	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..
Redruth	The Institution	10	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Retford, East	Wesleyan Day School	20	..	..	..	..	..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	20
Richmond	Petersham School	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Riddings	Mutual Improvement Association.	10	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..
Ripon	Training College	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	32
Rochdale	British School	172	115	110	110	..	..	..	25	..	37	87	..	..	..	35	..	35	..	..	..	..	..	..	..
Rothwell	" "	33	..	..	..	..	..	..	..	33	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rowley Regis	National School	23	..	..	..	..	..	..	..	..	..	..	..	..	..	23	..	..	..	..	..	..	..	..	..
Royton	St. Paul's National School	34	34	34	34	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Salford	Broughton Road Wesleyan School.	28	..	..	..	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Working Men's College	68	36	30	30	..	..	..	..	..	..	6	6	..	..	5	..	..	..	..	..	..	..	..	24
St. Austell	National School	29	..	..	18	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
St. Burian	National School	12	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
St. Helen's -	Commercial School -	25	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..
St. Ives -	National School -	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
St. Just -	The Institution -	14	..	..	..	..	..	..	..	..	..	..	..	9	9	..	..	..	..	5	..	..	..	..	7
Salisbury -	School of Science and Art -	25	20	2	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Saltaire -	Literary Institution -	18	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..
Saltley -	Training College -	43	..	..	..	43	..	..	..	..	..	..	..	..	..	43	..	..	..	..	..	..	..	..	43
Scarborough -	Mechanics' Institution -	23	..	..	..	6	..	..	..	..	..	..	..	3	..	2	..	..	7	..	..	2	..	..	3
Seaham -	Colliery School -	20	20	20	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Seaton Delaval -	Colliery School -	45	45	45	45	..	..	..	45	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Shaw - -	National School -	19	19	19	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sheerness -	British School -	26	26	26	6*	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sheffield -	Church and Educational Institute.	11	..	..	..	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	St. Paul's School -	121	..	..	..	9	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Mechanics' Institution -	38	..	..	..	..	..	..	..	..	..	138	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Wesleyan Educational Institute.	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Church Institute -	58	..	..	..	26	..	3	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	16
" -	School of Art - -	22	8	22	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Shelton -	National School -	18	..	..	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..
Shrewsbury -	School of Art - -	31	31	31	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Skelmanthorpe	National School -	12	..	..	..	6	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	7
Slough -	Mechanics' Institution -	46	40	40	40	..	..	..	..	..	..	18	18	..	..	..	..	..	..	..	..	..	..	..	..
Southampton	Hartley Institute -	211	..	..	..	11	..	..	..	..	..	..	..	..	..	200	..	..	..	..	..	..	..	..	..
Southminster	National School -	16	..	..	..	..	..	..	..	11	8	..	..	..	..	16	..	..	..	..	..	..	..	..	..
Southport -	Athenæum - -	14	..	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
South Shields	Mechanics' Institution -	19	..	..	..	..	..	..	..	..	..	..	..	..	..	19	..	..	..	..	..	..	..	..	..
" -	Tyne Docks Mechanics' Institution.	20	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..

,,	St. Hilda's C. Y. M. A.	52	52	52	52	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..
,,	Jarrow Chemical Works	30	29	29	29	..	..	..	29	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..
Stainland	Independent School	15	..	..	..	..	..	..	..	..	..	15	7	..	..	..	..	..	..	..	..	..	..	..	..
,,	Holywell Green Mechanics' Institution.	36	..	23	..	..	..	..	..	..	..	18	9	..	..	..	..	..	..	..	..	..	..	..	..
Stalybridge	Mechanics' Institution	23	23	23	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Staveley	Works' School	15	12	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	Village School	17	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stepney	Red Coat School	10	10	10	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	St. Paul's School	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	50
,,	Colet Boys' School	50	..	..	..	22	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..	..	50
Stockport	Mechanics' Institution	52	24	24	24	..	..	..	..	16	5	10	..	5	..	10	..	..	..	..	..	..	..	..	16
,,	Sunday School Improvement Society.	54	18	26	18	..	..	..	..	4	..	24	..	8	..	24	..	..	..	..	..	..	..	..	8
Stoke-on-Trent	School of Art	17	14	3	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stourbridge	Grammar School	26	9	..	..	..	..	..	..	..	..	26	..	..	..	9	..	..	..	..	..	..	..	..	..
Stratford (Essex)	Working Men's Hall	25	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	Boys' British School	30	30	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stratford-on-Avon	National School	12	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Stroud	The Institute	90	..	..	10	..	..	..	..	..	..	..	..	67	..	20	..	56	15	..	..	..	..	..	..
,,	School of Art	12	6	6	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sunderland	School of Art	44	26	12	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	Monk Wearmouth Colliery School.	39	39	39	39	..	..	..	39	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
,,	Working Men's College	25	25	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sunninghill	Wesleyan School	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Sutton	National School	21	..	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..	21
Sutton Coldfield	Town Hall	17	..	..	..	..	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..	..	..	..	17
Swansea	Royal Institute of South Wales.	91	15	5	4	48	..	7	6	9	11	25	..	..	..	..	..	..	..	..	3	16	..	..	..
,,	Oxford Street Nat. Sch.																								
Swinton	Mechanics' Institution	16	16	16	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tavistock	British School	60	..	..	..	3	..	..	..	..	..	15	..	..	..	16	..	..	..	..	..	..	..	..	40
,,	Duke of Bedford's School, Gulworthy.	60	..	..	..	..	..	..	..	37	..	..	..	..	..	14	..	..	..	..	..	..	..	8	35
,,	National School	80	..	..	..	16	..	..	..	..	..	17	..	..	..	..	..	24	..	..	..	..	..	..	63
,,	St. Mary Tavy National School.	18	..	..	..	..	..	..	..	..	..	..	..	..	..	8	..	..	..	..	..	..	..	..	18
Tavistock	School of Art	15	7	4	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tebworth	Wesleyan School	8	..	..	..	..	..	..	..	2	..	6	..	..	..	1	..	..	..	..	..	..	..	..	..
Thorne	Brooke's Grammar School	16	13	9	6	7	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Thornton	Mechanics' Institution	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Thrapston	National School	15	..	..	..	..	..	..	..	..	15	..	..	..	..	6	..	..	..	..	..	..	..	..	..
,,	British School	28	..	..	..	..	..	..	..	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	..
Toddington	National School	6	..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Toddington	Wesleyan School	14	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..
Todmorden	Mechanics' Institution	27	27	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Topsham and Woodbury.	Mutual Improvement Society.	25	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Torquay	School of Science and Art	93	..	..	..	..	..	..	..	29	91	..	..	..	..	24	..	..	..	..	..	..	..	..	..
Towcester	National School	14	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Truro	British School	24	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	24
"	Royal Institution	13	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..
Turton	Chapel-town Institute	17	17	17	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tyldesley	Mechanics' Institution	48	30	30	30	27	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ulverston	Proprietary School	18	..	..	..	12	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..
Wakefield	Holy Trinity Young Men's Society.	14	..	..	..	..	..	..	..	..	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Smyth Street Academy	30	..	..	..	..	..	..	..	..	30	30	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Mechanics' Institution	29	..	..	..	..	..	..	..	..	..	29	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Holy Trinity Boys' School	135	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	35
Walker	Alkali Works British School	21	21	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wallingford	School of Art	25	..	..	..	..	..	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..
Walsall	Wesleyan School	50	..	25	30	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	30
Watford	Literary Institution	36	..	..	..	..	..	..	..	..	..	..	..	..	..	36	..	..	..	..	..	..	..	..	..
Wednesbury	Moxley National School	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..
"	St. John's School	40	..	..	..	..	..	..	..	..	..	..	..	..	..	40	..	..	..	..	..	..	..	..	..
Weedon	Girls' School	12	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wellingborough	Lower Grammar School	64	..	..	..	..	..	..	..	23	51	..	..	..	..	28	..	..	..	..	..	..	..	..	..
West Bromwich	St. Peter's School	20	..	..	..	..	..	..	..	..	..	6	..	..	..	20	..	..	..	..	..	..	..	..	10
Westbury on Trym	Girls' National School	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
West Gorton	St. Mark's National School	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9

Whaleybridge -	Spring Bank Chapel -	8	8	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Whitehaven -	Science Association - -	30	..	..	..	..	..	..	..	..	..	28	..	6	..	..	..	..	..	..	..	..	..	..	..
Whitworth - -	Literary Institution - -	20	20	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wickham Market -	National School - -	12	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Wigan - -	Mech. Inst. - - -	95	36	42	42	..	..	..	..	..	..	32	..	..	..	2	..	..	..	22	..	..	..	23	4
Wilmslow - -	Fulshaw Day School -	9	9	8	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wilsden - -	Mechanics' Institution -	12	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..
Winchester - -	British School - -	15	..	..	..	8	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..
Windsor - -	Mechanics' Institution -	19	19	..	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Wisbech - -	Working Men's Institute	35	..	..	..	..	..	..	..	..	10	..	..	..	..	33	..	..	..	..	..	..	..	..	..
Woburn - -	Boys' School - - -	6	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Woking - -	St. John's School - -	41	..	..	..	7	..	5	..	36	..	21	..	..	..	37	..	..	..	..	..	..	..	..	34
Woking Station -	Commercial School, Knap-hill.	26	..	..	..	..	..	..	..	10	10	26	..	..	..	..	..	..	30	..	..	..	..	..	..
Wolverhampton -	Great Western Railway Institution.	33	26	..	..	28	..	..	..	..	..	33	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	St. Peter's School - -	40	..	..	..	..	..	..	..	20	..	..	..	30	..	30	..	..	..	..	..	..	..	..	30
" -	St. John's School - -	14	..	..	..	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	14
Wolverton - -	Science and Art Institution	56	10	10	..	22	..	18	..	46	46	18	..	..	..	27	..	..	..	..	18	..	..	..	..
Woodville - -	National School - -	6	..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..
Woolwich - -	Royal Arsenal Science Classes.	139	47	47	47	21	..	33	33	..	9	56	10	13	6	31	..	..	..	..	17	..	..	33	6
" - -	National School - -	24	16	24	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Pres. District School -	81	23	41	41	..	..	..	..	..	..	42	..	75	..	..	..	..	..	..	..	..	..	..	..
" - -	St. Michael's School -	14	14	14	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Worcester - -	Young Men's Christian Association. } St. Martin's School - } Grove House - }	286	73	45	..	..	..	..	..	..	44	38	..	74	..	211	..	..	..	..	..	..	..	..	..
" - -	St. John's School - -	52	..	..	..	..	..	..	..	..	..	..	..	..	..	52	..	..	..	..	..	..	..	..	..
" - -	Trade School - - -	42	42	42	42	..	..	42	42	42	42	..	..	..	..	42	..	..	..	..	..	..	..	42	42
" - -	Trade School Evening Class	52	30	30	30	..	..	23	23	20	20	..	..	..	..	25	..	..	..	..	..	..	..	23	20
Yarmouth (Great) -	Naval School and Grammar School.	100	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	80	80	..	..
" - -	School of Art - - -	9	8	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
York - - -	The Institute - - -	22	..	..	..	5	..	..	..	..	..	10	..	5	..	..	..	..	..	..	..	..	..	..	2
" - - -	Blue Coat School - -	17	..	..	..	15	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	15
" - - -	Training School - -	14	..	..	..	13	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	11
" - - -	Hope Street British School	72	..	..	..	..	..	..	..	..	..	72	..	..	..	..	..	..	..	..	..	..	..	..	..
" - - -	School of Art - - -	13	13	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
SCOTLAND.																									
Aberdeen	Mechanics' Institution	47	..	..	..	22	..	11	..	..	..	16	..	..	..	..	..	9	6	..	..	..	..	..	..
Alexandria	Mechanics' Institution	44	..	16	..	13	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..
Baillieston	Crosshill School	12	..	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Banton	Banton School	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Beith	New Street School	45	..	..	..	14	..	..	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	45
Brechin	School-room	28	10	..	..	1	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..
Corsock	Girls' School	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	5	..	..	..	..	..	..
Cults	School-room	12	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dingwall	Academy	13	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dumbarton	Burgh Academy	140	..	30	..	50	..	30	..	80	..	..	..	..	..	..	..	..	..	..	..	..	..	..	80
Dundee	High School	89	47	65	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Edinburgh	Free Church Training College.	56	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	40
"	Watt Institute	490	..	..	..	163	..	..	..	..	..	..	136	..	..	..	..	..	..	..	..	..	..	..	106
"	15, Buccleuch Place	24	..	..	..	..	..	..	..	..	..	..	..	..	..	24	24	24	..	..	..	..	..	..	..
"	Established Church Training College.	62	..	..	..	63	..	..	..	..	62	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Elgin	Academy	20	7	13	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Portrose	Mechanics' Institution	18	13	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13
Glasgow	Secular School	131	23	23	..	..	..	..	..	..	..	17	..	..	..	86	50	..	..	..	17	..	..	..	64
"	Andersonian University	992	..	..	..	22	12	..	873	..	..	406	406	..	..	191	..	135	135	..	..	..	..	370	..

„	Mechanics' Institution	218	..	..	..	118	..	..	..	..	..	100	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Established Church Normal School.	54	..	..	..	..	..	..	..	..	..	..	..	..	..	54	..	..	..	..	..	..	..	..	..
„	St. Stephen's School	26	..	..	..	26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Port Dundas School	33	..	..	..	..	..	..	..	..	..	..	..	..	..	33	..	..	..	..	..	..	..	..	..
„	St. George's School	50	..	..	..	..	..	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..
Inverness	School of Science and Art	18	16	6	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Royal Academy	41	20	1	2	37	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Johnstone	Quarrelton Parish School	46	..	..	..	..	..	..	..	..	..	..	..	..	..	46	..	..	..	..	..	..	..	..	..
Kilmarnock	East George St. Academy	82	42	42	..	25	..	..	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	New Academy	52	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	40
„	School of Art	7	..	6	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kirkcaldy	Burgh School	34	..	34	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kirkwall	Grammar School	35	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21
Leith	Navigation School	278	..	..	..	138	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	172	165	68	..
„	St. James' School	39	..	..	..	..	..	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	35
„	School of Art	34	34	17	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lumphanan	Parish School	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13
Nairn	Gen. Assembly's School	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Newhills	Stoneywood School-room	11	..	..	..	11	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Paisley	School of Art	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
„	Sessional School	44	..	..	..	..	..	..	..	..	..	..	..	..	..	44	..	..	..	..	..	..	..	..	..
Perth	Sessional School	9	4	2	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rothesay	Thomson Institution	6	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
St. Andrews	Madras College	63	..	44	..	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stirling	Science and Art School	18	18	18	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tarbat	Parochial School	34	..	..	..	28	..	..	..	..	..	..	..	34	..	20	20	..	..	..	..	18	..	..	34
	IRELAND.																								
Aghnagar	National School	25	..	..	..	..	..	..	..	25	25	..	..	..	..	..	..	..	..	..	..	..	..	..	25
Ahoghill	National School	20	..	..	..	..	..	..	..	20	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Anahilt	Endowed Free School	15	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	15
Antrim	Male National School / „ Main St. National School / „ Ladyhill National School	70	..	..	..	10	..	..	..	..	28	..	..	12	..	14	..	..	..	..	..	..	..	..	30

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Ardara - -	Female National School -	15	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15
Armagh - -	Gosford Place National School.	63	..	..	..	20	..	..	..	63	62	..	..	40	..	19	..	..	..	..	..	..	..	..	23
" - -	College Street School -	30	..	..	..	..	..	..	..	30	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..
Athlacca - -	National School - -	18	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Athlone - -	St. Mary's School - -	34	..	..	..	..	..	..	..	16	12	..	..	25	..	22	..	..	..	..	..	..	..	25	..
" - -	Ranelagh School - -	26	17	..	..	25	..	19	..	21	21	..	..	25	..	25	25	..	..	..	..	..	..	..	..
" - -	Anchorsbower National School.	56	..	..	..	22	..	..	..	40	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Athy - -	Town Hall - - -	32	..	..	..	..	..	..	..	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Aughnacloy - -	Court House - - -	49	..	..	..	..	..	..	..	49	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bagenalstown -	National School - -	30	..	..	..	23	9	23	..	30	30	..	..	..	..	9	..	..	..	..	..	..	..	..	..
Bailieboro' - -	Model School - - -	122	..	..	..	30	..	..	..	..	122	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballee - -	National School - -	19	..	..	..	..	..	..	..	17	11	..	..	..	..	..	..	..	..	..	..	..	..	..	11
Ballincollig - -	National School - -	15	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballybay - -	National School - -	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15
Ballybofey - -	Town Hall - - -	36	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	36
Ballymena - -	Model School - - -	15	..	..	..	15	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Guy's National School -	14	..	..	..	..	..	..	..	14	14	..	..	..	..	10	..	..	..	..	..	..	..	..	..
" - -	National School - -	10	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Harryville National School	12	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Crebilly National School -	6	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballymoney - -	Town Hall - - -	28	..	..	..	10	..	..	..	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	28
Ballynahinch -	National School - -	13	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13
" -	Town Hall - - -	10	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10
Ballyvicknakelly -	National School - -	10	..	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	10
Ballywalter - -	Park School - - -	36	..	..	..	..	..	..	..	..	16	..	..	18	..	20	..	..	..	..	..	..	..	..	..
Ballywillie - -	National School - -	14	..	..	..	12	..	..	..	14	14	..	..	..	..	10	..	..	..	..	..	..	..	..	14

Balyna	National School	27	..	..	..	..	..	..	..	..	27	..	..	27	..	5	..	..	..	..	..	..	..	..	..
Bandon	Allin Institution	50	..	..	..	17	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	45
Bangor	Endowed School	16	..	..	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..
Barnesmore	National School	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	18
Belfast	Fisherwick Place School	71	..	..	..	22	..	10	..	9	9	..	..	..	..	24	..	..	..	..	..	..	..	..	31
"	Frederick Street National School.	36	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	36
"	Wellington Academy	32	..	..	..	31	..	20	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Victoria Place School	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	50
"	Northumberland Street National School.	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
"	Union Place National School	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..
"	Conway Street National School.	22	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Model School	60	29	29	29	59	..	40	..	40	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Academy Street, No. 1, National School.	54	..	..	..	..	..	..	..	32	42	..	..	23	..	9	..	..	..	..	..	..	..	..	..
		20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
"	Linfield Road National School.	35	..	..	..	..	..	..	..	..	..	..	..	35	..	..	..	..	..	..	..	..	..	..	..
"	Brown Street National School.	56	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	56
"	Nelson Street National School.	34	..	..	..	26	..	..	..	28	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	People's Literary Institution.	27	..	11	11	9	..	5	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11	10
"	May Street National School	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15
"	Mercantile Academy	35	..	..	..	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Bridge End National School	10	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	New Road Street National School.	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	23
"	Townsend Street National School.	60	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	60
"	Albion Street National School.	16	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16
"	Canning Street Academy	44	..	..	..	..	..	..	..	..	36	..	..	..	..	..	..	..	..	..	..	..	..	..	18
"	Tennent Street National School.	12	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Belfast	Clarence Place Hall	12	..	..	..	9	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Beragh	Loan Fund Office	16	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bessbrook	School House	10	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bonecastle	National School	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10
Bornafea	National School	9	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Bruckless	National School	30	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30
Bushmills	National School	22	..	..	..	..	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Caledon	School House	10	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..

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Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Callan	Academy	26	..	..	..	..	..	26	..	..	26	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Carlow	Christian School	28	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Carrickfergus	Model School	42	..	..	..	13	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	7	6	..	35
Castleblaney	Annayallo National School	12	..	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Castlederg	Edward's School	26	..	..	..	21	..	..	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	25
Castlewellan	Annsboro' National School	15	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cloncore	National School	10	..	..	..	2	..	..	..	10	2	..	..	..	..	2	..	..	..	..	..	..	..	..	2
"	Eglish National School	12	..	..	..	6	..	..	..	12	3	..	..	..	..	4	..	..	..	..	..	..	..	..	12
Clonmel	Model School	32	..	..	..	32	..	..	..	..	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Mechanics' Institution	12	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Coal Island	Infant School	31	..	..	..	..	..	..	..	..	31	..	..	..	..	..	..	..	..	..	..	..	..	..	31
Coleraine	Model School	48	..	..	..	..	..	..	..	..	39	..	..	..	..	..	..	..	..	..	..	..	..	..	16
Comber	Smyth's National School	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Lisbarnet National School	20	..	..	..	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..
Connor	National School	18	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cooraclare	National School	40	..	..	..	37	..	..	..	27	27	..	..	..	..	..	..	..	..	..	..	..	..	..	40
Cork	Central Model School	37	..	..	..	32	..	..	..	34	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..
"	Carmichael National School	65	..	..	..	28	..	..	..	..	..	..	..	..	..	18	..	..	..	..	..	..	..	..	58
"	St. Nicholas National School	59	..	..	..	32	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	59
"	School of Art	12	12	12	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cormeen	National School	22	..	..	..	..	..	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	22
Cottown	National School	35	..	..	..	..	..	..	..	33	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Crossgar	National School	13	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cullybackey	National School	73	..	..	..	..	..	..	..	73	73	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Teesham National School	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	35
Derrygonnelly	Lisded National School	31	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30
Derrylin	Kinawley National School	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Donaghadee	National School	48	..	..	..	..	..	..	..	48	..	..	..	..	..	48	..	..	..	..	..	..	..	..	..

"	Shore Street National Sch.	20	..	..	..	..	..	..	..	18	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Donoughmore	Lecture Room	7	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	6
Downpatrick	John Street National School	40	..	..	..	12	..	..	..	31	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Drogheda	St. Mary's National School	16	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dromara	Court House	14	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	14
Dromore	Corbally National School	14	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Drumaviah	National School	43	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	43
Drumlough	National School	12	..	..	..	..	..	..	..	12	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..
Dublin	Central Model School	199	..	15	17	..	..	..	..	169	..	..	..	..	..	..	..	..	..	..	..	..	..	..	28
"	55, Aungier Street	20	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8	..	..	12
"	Methodist School	30	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Young Men's Christian Association.	12	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Dundalk	Free Library																								
"	Educational Institution	95	20	32	32	47	..	4	..	27	37	40	..	..	..	..	..	..	..	..	..	31	..	..	40
"	Quay Street School																								
"	Jocelyn Street																								
Dundrod	National School	28	..	..	..	8	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dundrum	Endowed School	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	24	..	..	..
Dungannon	Parochial School	30	..	..	..	..	..	..	..	8	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Dungiven	National School	12	..	..	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Dunmanway	Chapel School-house	64	..	..	..	64	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Reenoscrena National School	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ederney	Moneyvriece and Aghaghaffart National School.	14	..	..	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Enniskillen	Model National School	50	..	..	..	..	..	..	..	..	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Rossdoney National School	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21
Galway	Model School	18	..	..	..	18	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gilford	National School	38	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	37
Grange O'Neilland	Parochial School	16	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16
Grey Abbey	National School	20	..	..	..	12	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Hillsborough	Boys' School	30	..	..	..	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30
Holywood	Sullivan's Sch. and Acad.	78	..	..	..	26	..	..	..	..	50	50	..	..	..	45	..	..	..	..	..	..	..	..	60
Kilkee	National School	43	..	..	..	43	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kilkenny	Model School	56	..	..	..	15	..	..	..	..	37	..	..	..	..	..	..	..	..	..	..	..	..	..	53
"	Model Farm																								
"	Pocock Institution	31	..	..	..	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	31
Killinchy	Schoolroom	30	..	..	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..
Killybegs	National School	28	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	28
Killylea	School House	24	..	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kilmihil	Leitrim National School	13	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10
Kilmore	School	20	..	..	..	16	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Kircubbin	National School	13	..	..	..	..	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	13

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light, and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Kircubbin	Glastry National School	26	..	..	..	..	..	..	..	..	..	..	..	26	..	26	..	..	..	..	..	..	..	..	..
Larne	Model Agricultural School	29	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..	..	16
Larne and Inver	National School	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..
Letterkenny	National School	38	..	..	..	35	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7
Ligoniel	Wolfhill Mill	17	..	..	..	..	..	..	..	5	15	..	..	..	..	17	..	..	..	..	..	..	..	..	..
Limerick	Athenæum	14	9	8	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lisnagry	Ahane National School	15	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Londonderry	Model School	51	..	..	..	14	..	..	..	47	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Gwyn's Institution	26	..	..	..	..	..	..	..	26	..	..	..	..	..	26	..	..	..	..	..	..	..	..	26
Lough Cutra	National School	8	..	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lurgan	Model School }																								
"	Mechanics' Institution }	45	..	..	..	30	..	..	..	..	42	..	..	..	..	..	..	..	..	..	..	..	..	..	28
"	National School }																								
Macroom	National School	22	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Magherafelt	No. 2 National School	43	..	..	..	..	..	..	..	..	43	..	..	..	..	43	..	..	..	..	..	..	..	..	..
Manorhamilton	Court House	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Markethill	Coolmalish National School	14	..	..	..	6	..	..	..	7	7	..	..	..	..	8	..	..	..	..	..	..	..	..	14
Millisle	National School	10	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..
Millstreet	National School	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30
"	Cullin National School	40	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	40
Monaghan	Model School	53	..	..	..	..	..	..	..	33	33	51	..	..	..	..	..	..	..	..	..	..	..	..	51
"	Corcaghan National School	28	..	..	..	..	..	..	..	..	28	..	..	..	..	..	..	..	..	..	..	..	..	..	..
"	Aghnalogh National School	20	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Moy	National School	18	..	..	..	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Moira	Brookfield Agricultural School.	20	..	..	..	..	..	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	20
Moyasta-Kilrush	National School	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Mullinavatt -	Class Room -	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7	..	..	..	..	..	..	..
Newry -	Model School -	104	..	..	..	..	..	..	..	..	104	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Cloughoge National School	29	..	..	..	29	..	..	..	29	29	..	..	..	..	29	..	..	..	..	..	..	..	..	92
Newtownards -	Model School -	133	..	..	..	..	..	..	..	..	19	..	..	80	..	80	..	..	..	..	..	..	..	..	..
" -	No. 2 National School	26	..	..	..	10	..	..	..	..	..	..	..	18	..	20	..	..	..	..	..	..	..	..	..
" -	Ballyblack Schoolroom	22	..	..	..	..	..	..	..	..	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..
" -	Loughriescous National School.	48	..	..	..	..	..	..	..	..	..	..	..	48	..	..	..	..	..	..	..	..	..	..	..
Newtownbreda -	National School	26	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	26
Newtown Limavady	Town Hall	44	..	..	..	20	..	..	..	40	..	..	..	..	..	39	..	..	..	..	..	..	..	..	..
Newtown Stewart -	Model School -	24	..	..	..	..	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	Lower Langfield National School.	22	..	..	..	..	..	..	..	..	..	..	..	22	..	..	..	..	..	..	..	..	..	..	22
Oldcastle -	Endowed School	140	..	..	..	37	..	..	..	..	..	..	..	..	..	..	..	60	..	..	..	..	..	..	80
Omagh -	Model School	49	..	..	..	28	..	..	..	30	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Parsonstown -	Model School -	48	..	..	..	17	..	14	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	46
" -	Young Men's Christian Association.	11	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11
Portadown -	Edenderry National School	15	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10
" -	Baptist Meeting House	15	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	10
" -	Temperance Hall	6	..	..	..	5	..	..	..	5	5	..	..	..	..	1	..	..	..	..	..	..	..	..	5
Portaferry -	No. 1 National School	39	..	..	..	39	..	..	..	..	39	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" -	No. 2 National School	21	..	..	..	..	..	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ramelton -	Robertson's National School	15	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Raphoe -	National School	17	..	..	..	14	..	..	..	17	..	..	..	..	..	17	..	..	..	..	..	..	..	..	17
" -	Convoy Concert Hall	10	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rathfryland -	Town Hall	9	..	..	..	9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4
Rich Hill -	Ballynahinch National School.	18	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	12
Roscrea -	National School	45	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	45
Rosscarbery -	Mount Fachnanus National School.	50	..	..	..	50	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Roslea - / " -	Greaghawarren National School. / Deerpark " "	25	..	..	..	..	..	..	..	..	25	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Santry -	Training School	63	..	..	..	40	20	20	..	40	40	..	..	..	..	40	..	..	40	..	..	20	20	..	40
Scariff -	National School	32	..	..	..	24	..	..	..	24	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sixmile Cross -	National School	15	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Skibbereen -	National School	10	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Sligo -	St. John's National School	20	..	..	..	20	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stewartstown -	Schoolroom	37	..	..	..	..	..	..	..	..	37	..	..	..	..	..	..	..	..	..	..	..	..	..	37

Table showing the Classes in each of the preceding Science Schools, &c.—*continued.*

Town.	Where held.	Total No. of Individual Students.	I. Practical, Plane, and Solid Geometry.	II. Machine Construction and Drawing.	III. Building Construction or Naval Architecture.	IV. Elementary Mathematics.	V. Higher Mathematics.	VI. Theoretical Mechanics.	VII. Applied Mechanics.	VIII. Acoustics, Light and Heat.	IX. Magnetism and Electricity.	X. Inorganic Chemistry.	XI. Organic Chemistry.	XII. Geology.	XIII. Mineralogy.	XIV. Animal Physiology.	XV. Zoology.	XVI. Vegetable Anatomy and Physiology.	XVII. Systematic & Economic Botany.	XVIII. Mining.	XIX. Metallurgy.	XX. Navigation.	XXI. Nautical Astronomy.	XXII. Steam.	XXIII. Physical Geography.
Strabane	Tullywhisker National School.	7	..	..	..	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Parish School - -	30	..	..	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
" - -	Town Hall - - -	31	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	31
Templepatrick -	Lylehill Nat. School -	13	..	..	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Trim - - -	Model School - -	60	..	..	..	..	..	..	..	..	..	..	..	..	..	60	..	..	..	..	..	..	..	..	60
Tulla - - -	National School - -	12	..	..	..	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tullamore - -	Charleville Schools -	25	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	25
Waterford -	Model School - -	49	..	..	..	23	..	..	..	43	..	..	..	31	..	..	..	..	..	..	..	..	..	..	..
" - -	Newtown School -	30	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30	..	..	..	..	..	..	..
Total number of Classes -		2,204	257	247	226	221	6	57	47	134	170	191	23	64	8	220	8	27	14	4	7	22	8	25	219
" " Students -		29,956	6,413	6,338	{ 49* 5374 }	5,078	83	1,064	1,345	3,306	4,584	5,182	873	1,643	135	6,131	151	717	310	40	74	536	349	900	7,034
810 Schools.																									

* Naval Architecture.

INDEX.

LONDON:
Printed by GEORGE E. EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty.
For Her Majesty's Stationery Office.
[9658.—2000.—12/70.]